TETRA TECH

March 30, 2017

Mr. Steve Wolfe
Federal On-Scene Coordinator
U.S. Environmental Protection Agency Region 5
25063 Center Ridge Road
Westlake, Ohio, 44145

Subject: Warren Steel Holdings Sampling and Analysis Plan (Final)
4000 Mahoning Avenue, Warren, Trumbull County, Ohio
EPA Contract No. EP-S5-13-01 (START IV, Region 5)
EPA TDD No. S05-0001-1612-007
Document Tracking No. 1411

Dear Mr. Wolfe:

The Tetra Tech, EMI Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) is submitting the Sampling and Analysis Plan (SAP) for the Warren Steel Holdings, LLC (WSH) site in Warren, Ohio for review and approval. The SAP summarizes the drum/container, transformers, and oil pit sampling event that will occur at a date to be determined in the near future (based upon weather conditions). Attachments include tables summarizing the number of proposed samples and bottleware, figures illustrating the site location (**Attachment 1**), and Tetra Tech Standard Operating Procedures (SOP) (**Attachment 2**) relevant to this removal assessment. The proposed technical approach has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) Performance Work Statement for the subject contract.

If you have any questions or comments regarding this report, please contact me at 419-262-0108.

Respectfully,

Don Newton

Don Newton
START IV, Region 5 Project Manager

Enclosures

cc: Kevin Scott, Tetra Tech Program Manager
TDD file

ABBREVIATED SAMPLING AND ANALYSIS PLAN

WARREN STEEL HOLDINGS SITE

TDD#:	S05-0001-007
EPA OSC:	Steve Wolfe
SITE NAME:	Warren Steel Holdings Site
SITE LOCATION:	4000 Mahoning Avenue, Warren, Ohio
SAMPLING ACTIVITIES:	Drum/container, transformers, oil pit sampling
SAMPLING DATES:	TBD
SAP PREPARER:	Don Newton
SIGNATURE/DATE:	3/30/2017
QC REVIEWER:	Ed Shuessler
SIGNATURE/DATE:	3/30/2017
USEPA OSC APPROVAL SIGNATURE/DATE:	
Document Tracking Number (DTN)	1411

INTRODUCTION:

This abbreviated Sampling and Analysis Plan (SAP) identifies the sampling methods, equipment, and quality assurance/quality control (QA/QC) measures specific to the Warren Steel Holdings (site) removal assessment. The SAP follows the procedures described in the Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) IV Quality Assurance Project Plan (QAPP) (Tetra Tech 2016).

SCOPE OF WORK:

Under Technical Direction Document (TDD) S05-0001-1612-007, the U.S. Environmental Protection Agency (EPA) Region 5 tasked Tetra Tech START to assist with drum/container and other sampling activities at the site. The Warren Steel Holdings site is located at 4000 Mahoning Avenue in Warren, Trumbull County, Ohio. The removal assessment tasks are designed to document the potential for imminent and substantial threats to the public health or welfare of the United States or the environment. The objective of the sampling activities is to characterize select waste materials at the site and determine if the material is Resource Conservation and Recovery Act (RCRA) hazardous or Toxic Substances Control Act (TSCA) polychlorinated biphenyl (PCB)-containing waste. As directed by EPA, waste samples collected at the site will be analyzed for pH, flashpoint, and polychlorinated biphenyls (PCBs). Tetra Tech will also conduct field screening activities. Specifically, START and EPA will perform the following activities during the removal assessment:

- Utilize a Ludlum Model 19 micrometer, a MultiRAE 5-gas meter and pH test strips to field screen potential sample locations based on the site inspection and information obtained from the OSC.

- Collect up to three liquid/oil or wipe samples from transformers located on the western portion of the site. Samples will be analyzed for PCBs via SW-846 Method 8082A.

- Collect up to 20 liquid/sludge or solid waste samples from drums and/or containers to be analyzed for pH via EPA SW-846 Method 9045D, flashpoint via SW-846 Method 1010A and PCBs via SW-846 Method 8082A. Duplicate samples and a matrix spike /matrix spike duplicate (MS/MSD) will also be collected for quality assurance/quality control (QA/QC) purposes. A duplicate sample will be collected for every 10 samples collected and one MS/MSD sample for every 20 samples collected. Locations and specific analysis for each sample will be determined in the field based on field screening results and at the direction of the OSC.
- Collect two liquid/oil samples from a PCB waste pit located near the west end of the 36" Mill Building. Samples will be analyzed for PCBs via SW-846 Method 8082A. The dimensions of the pit will be verified by use of telescoping poles and an EPA provided "down-hole" camera. START will also attempt to determine the consistency of the bottom layer of the pit (i.e. sandy, silt thickness, and so on).Document all activities, including data and field measurements, in a field logbook, on field data sheets, container inventory logs, or with photographs in accordance with Tetra Tech SOP No. 024 "Recording Notes in Field Logbooks."

- Submit a removal assessment report that summarizes all field activities and validated analytical results. The report will include validated analytical data compared to RCRA hazardous waste characteristics, and TSCA PCB-containing waste criteria. The report will also include site field notes, container logs, site photographs and site figures depicting sampling locations. Field and validated analytical data will be imported into a SCRIBE database.

PROJECT TEAM:

The personnel listed in the table below will be involved in planning and technical activities for the site. The EPA project personnel and each field team member will receive a copy of the SAP, and a copy will be retained in the site file.

Personnel	Title	Organization	Phone Number	Email
Steve Wolfe	OSC	EPA Region 5	NON RESPONSIVE [redacted]	
Kevin Scott	Program Manager	START		
Chris Draper	H&S Manager	START		
Don Newton	Project Manager	START		
Wes Williams	Field Team Leader	START		

Notes:
EPA = U.S. Environmental Protection Agency
OSC = On-Scene Coordinator
START = Superfund Technical Assessment and Response Team

SITE LOCATION:

The site is located at 4000 Mahoning Avenue in Warren, Trumbull County, Ohio. **Figure 1** in **Attachment A** illustrates the location of the site on the U.S. Geological Survey (USGS) 7.5-Minute Topographic Quadrangle for Trumbull County, Ohio (USGS 1994). The geographic coordinates at the center of the site are 41°16'19.3 North latitude and 80°51'4.30° West longitude.

SITE DESCRIPTION:

The site covers approximately 400 acres and is bound to the north by the Warren Outerbelt; to the east by Mahoning Avenue and the Mahoning River; to the south by North River Road; and to the west by residential property. Topography across the site slopes gently to the west and the elevation is approximately 913 feet above mean sea level.

SITE HISTORY:

Warren Steel Holdings, LLC is a closed steel manufacturing facility. WSH operated at the site until January 2016 when operations ceased. Information reviewed indicates Ohio Environmental Protection Agency and EPA have conducted several inspections at the site since 2007. A final inspection was conducted in January of 2016, in which several notice of violations were issued. WSH failed to address some of these violations prior to ceasing operation in January of 2016. Several areas of hazardous waste, universal waste, PCB-contaminated oil, asbestos, water and wastewater treatment chemicals, electric arc furnace dust (EAF), non-hazardous slag, lime, ignitable aerosol drums, transformers, radiation sources, and miscellaneous unknown materials still exist at the site (see **Figure 2** in **Attachment A)**.

WSH manufactured various sizes of solid steel billets from scrap steel they bought from their broker, Tube City. Ohio Star Forge purchased some land at the northwest corner of the site, but accesses their property through WSH property at the main WSH gate. The northeast portion of the site is leased to Scrap Metal Services which utilizes the same access road from Mahoning Avenue and is located on the north side of the WSH main gate. Stein, Inc. leases approximately 20 acres of the site property located north of North River Road in the central part of WSH, just south of the Melt Shop. There are numerous abandoned buildings on the property, mostly left over from when the site operated as Copperweld Steel Company (Copperweld). Copperweld operated at the site from the 1940's until 2001. Most of the buildings have had the production equipment removed, but some of the buildings still house raw materials, chemicals, drums and containers. Some of the buildings also have old equipment pits containing unknown liquids and at least one that has PCB-containing oil. A site visit conducted by EPA in March of 2016 indicated that four radiation sources are present on site (three in the caster building and one in the lab), but were not accessible. These areas were also not accessible during the EPA visit during December of 2016. Copperweld still owns about 100 acres on the southwest portion of the site.

SAMPLE COLLECTION:

During the removal assessment, START and EPA will collect up to three samples from abandoned transformers located on the western portion of the site; approximately 20 liquid/sludge or solid samples from waste/drum containers throughout the site for laboratory analysis. START will also collect two liquid/oil samples from the PCB waste pit near the 36-inch Mill Building. The sampling procedures are described below in order of occurrence.

Prior to field screening, calibration of all field equipment will be performed in accordance with manufacturer specifications and recorded in the field logbook. START will visually observe the conditions of any drums or containers noting any deteriorations, dents, bulges, or crystallization around seams, bungs, sides of the drum and evidence of leakage around the drum. Prior to opening any drums, field screening will be conducted with the MultiRAE and Ludlum Model 19 micrometer to determine if any hazardous airborne concentrations or radioactivity are present in and around the source area.

START will examine the transformers observed on site and attempt to collect a liquid sample of any visible or leaking substance on or around the transformer. Wipe samples will also be utilized to collect samples from any leaking or staining on the transformer itself. Laboratory provided sample containers (with pre-moistened hexane wipes) will be used to collect the wipe samples for analysis. Laboratory provided sample containers (with no pre-moistened hexane wipes) will be used to collect soil from any stained soil areas.

START will collect liquid and/or solid waste samples from the drums and other containers located onsite. Drum and/or container sampling will be conducted in accordance with Tetra Tech SOP No. 008-2, "Containerized Liquid, Sludge, and Slurry Sampling". Drum and/or container sampling locations will be selected based on observations obtained in the field. Drums and containers will be marked for future reference. In order to collect samples, Tetra Tech will use disposable Coliwasa samplers. Based upon site observations and results of field screening, portions of the drum and/or container sampling will be conducted using Level B personal protective equipment (PPE) due to the unknown contents of containers.

Samples will be collected using a disposable Coliwasa sampler slowly inserted through an opening at the top of the container and pushed through to the bottom of the container being sure to capture all stratified layers, if present. When the stopper reaches the bottom of the container or a solid layer, the Coliwasa sampler will be dropped against the stopper to close and lock contents in place. Following removal from the container, the contents of the Coliwasa sampler will be deposited into a large plastic bag, double bagged and sealed for later disposal. If stratified layers are present, each layer will be placed into a separate sample container. Samples will be poured directly into appropriate containers (see Table 2). Samples will be immediately placed in an iced cooler and maintained at a temperature of 4 ± 2°C without freezing until they are delivered to the laboratory under standard chain of custody protocol.

Depending on the depth and dimensions of the PCB oil pit, a Coliwasa or a weighted, bottom-loading bailer-type device will be used to sample the liquid in the pit. A long-handled scoop may also be used to grab a sample from the surface layer of the oily or liquid substance in the pit. The liquid will be observed for layering. If multiple layers are observed in the pit liquid, all layers will be sampled and submitted for laboratory analysis.

Samples will be assigned a unique identification number composed of the following information:

- Project name – WSH- Warren Steel Holdings
- Sample number/name – Liquid Waste 01 = LW-01, Solid Waste 01 = SW-01, Bulk Material 01= BM-01, Surface Soil SS-01 = SS-01, Subsurface Soil 01 = SB-01
- Date (mmddyy) = 022817
- Example = WSH-LW-01-022817

The site name, sample time and date, analytical method, sampler initials, sample matrix, and preservation method information will be captured on the laboratory-supplied bottleware labels.

Table 1 is a compilation of sample matrix, analytical methods, number of QA/QC samples, and total samples to be collected. Sample volumes, containers, preservation techniques, and holding times are included in **Table 2**. **Attachment 2** contains SOPs that will be used during the removal assessment.

SAMPLE HANDLING:

Following sample collection, the samples will be placed in an iced cooler and maintained at a temperature of 4°C ± 2°C until they are delivered to the laboratory under standard COC protocol. The samples will be labeled, packaged, and shipped in accordance with procedures outlined in Worksheet No. 26 and No. 27 of Tetra Tech's START QAPP and Tetra Tech SOP No. 019, "Packaging and Shipping Samples"

(**Attachment 2**). Samples will be shipped under signed chain-of-custody and analyzed by CT Laboratories, LLC in Baraboo, Wisconsin. Standard turnaround time will be requested for the analytical methods required.

QUALITY ASSURANCE/QUALITY CONTROL:

Field blank QA/QC samples will be collected daily throughout the extent of sampling activities. Blind duplicate QA/QC samples will be collected at a frequency of ten (10) percent. MS/MSD samples will be collected in the frequency of one (1) for every 20 samples collected for each individual analysis. One (1) equipment rinsate blank will be collected for each day of sampling from any reusable sampling equipment. The Tetra Tech field team manager will be responsible for ensuring that sample quality and integrity are maintained and that sample label and documentation procedures are in accordance with the START QAPP and this site-specific abbreviated SAP. When the results are received, a qualified Tetra Tech START chemist will review the laboratory data packages for completeness in accordance with Tetra Tech's START QAPP and EPA's National Functional Guidelines (Tetra Tech 2016 and EPA 2016). Laboratory results will be submitted in a Level II analytical data validation package.

DECONTAMINATION:

Dedicated sampling equipment will be used to the maximum extent practical to minimize cross-contamination and the need for decontamination. All non-dedicated sampling equipment will undergo a gross decontamination with Alconox®, followed by a double rinse with distilled water in accordance with Tetra Tech SOP No. 002, "General Equipment Decontamination" (**Attachment 2**). Where non-dedicated equipment is used, a rinsate sample will be collected each day that work is performed. Any investigated derived waste generated will be segregated and stored at the site for future disposal.

DATA REPRESENTATIVENESS:

The SAP is designed to obtain data representative of site conditions. If sampling activities vary significantly from this plan because of unexpected conditions in the field or other unforeseeable factors, START will discuss in the removal assessment report how those variations affect data representativeness.

The laboratory will submit analytical data in electronic form. The laboratory results will be validated by a Tetra Tech START chemist. After the data set has been validated and the appropriate data qualifiers have been attached, the electronic data will be released to the START project manager for reporting and Tetra Tech will import the data into the Scribe database.

DELIVERABLES:

START will submit a removal assessment report to EPA that summarizes sampling activities, analytical results (with comparison to RCRA Hazardous Waste characteristics, and TSCA PCB-containing waste criteria), and provide conclusions.

REFERENCES:

Tetra Tech, Inc. 2016. *Quality Assurance Project Plan for Superfund Technical Assessment and Response Team (START IV) Contract No. EP-S5-13-01*. Chicago, IL. June. Revision 3.

EPA. 2016. *National Functional Guidelines for Superfund Organic Methods Data* Review. EPA-540-R-2016-002. September. United States Geological Survey. *Warren, Ohio Quadrangle.* [ca. 1:24,000]. Photorevised 1994.

TABLE 1
SAMPLING REQUIREMENTS WORKSHEET

Matrix*	Parameter	Number of Investigative Samples[a]	Number of Quality Control (QC) Samples[b]				Number of Investigative and QC Samples[c]
			Field Duplicate	MS/MSD	Equipment Blank	Trip Blank	
Liquid or Wipe samples from transformers	PCB	3	1	0	0	0	4
Liquid or Waste (from drums/containers)	pH	20	2	1	1	0	23
	Flashpoint	20	2	1	1	0	23
	PCBs	20	2	1	1	0	23
Liquid/sludge sample from PCB Pit	PCBs	2	1	0	0	0	3

Notes:

* Waste may be in solid or liquid form

[a] Refer to Table 2 for required sample volumes, containers, preservation techniques, and holding times.

[b] Refer to Worksheet 20 (Field Quality Control Sample Summary) of the Tetra Tech, Inc. START Region 5 Quality Assurance Project Plan (QAPP) for typical QC sample types and frequencies.

[c] MS/MSD samples are not included in the total sample number because no separate sample is required for MS/MSD analysis, only extra volume is collected for a sample designated for MS/MSD analysis.

EPA U.S. Environmental Protection Agency

MS/MSD Matrix spike/matrix spike duplicate
PCBs Polychlorinated Biphenyls
SW-846 U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)

TABLE 2
SAMPLE VOLUMES, CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

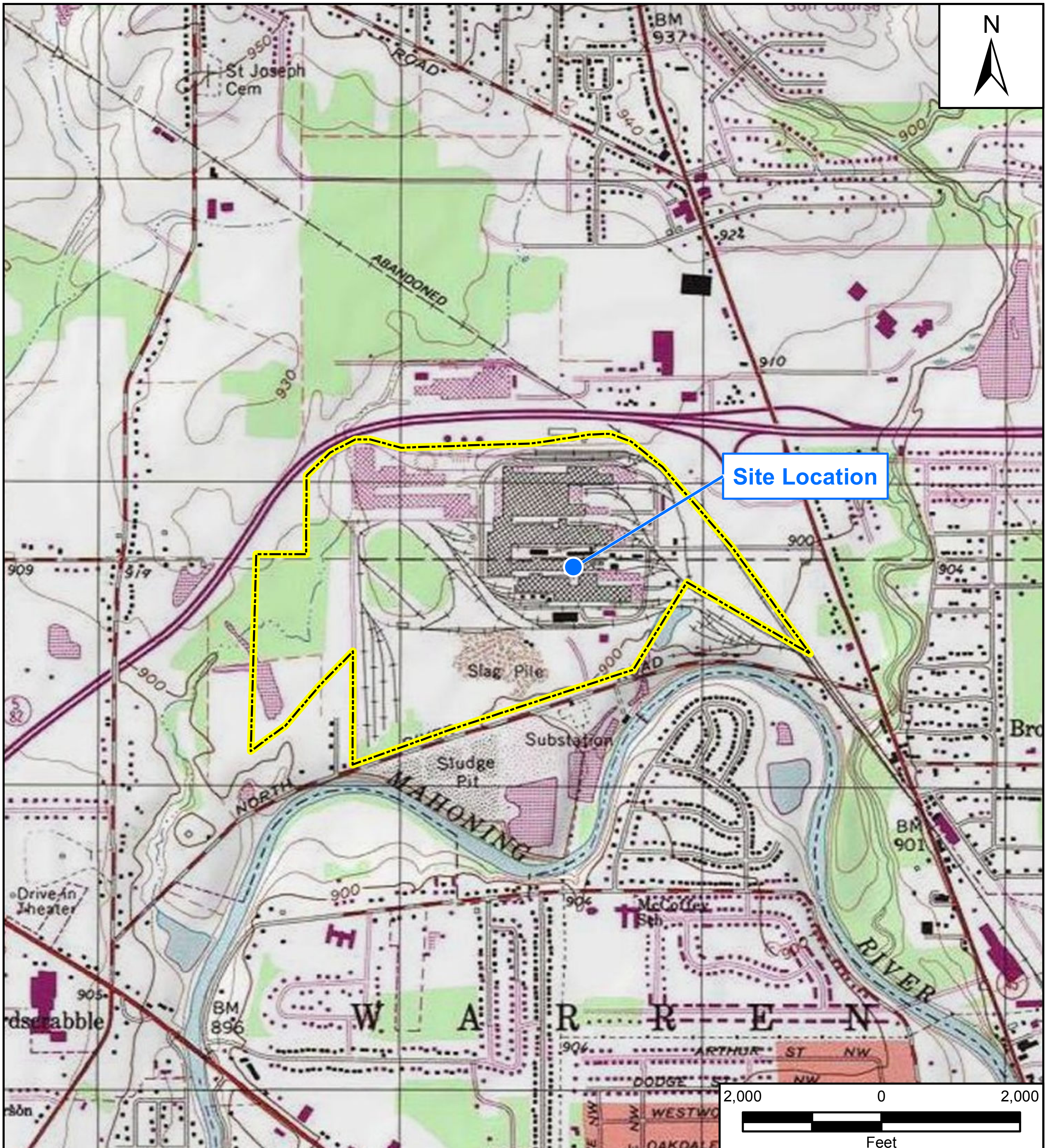
Matrix *	Parameter	Concentration Level	Analytical Method	Volumes and Containers	Preservation	Holding Time
Wipe Sample (from transformers)	PCBs	NA	SW-846 8082A	4-ounce glass jar	4” gauze pad pre-moistened with Hexane	14 days
Liquid or Waste (from drums, containers, PCB pit and transformers)	pH	NA	SW-846 9045D	Between 50-125 mL HDPE bottle with polyethylene-lined cap	Cool to 4 ˚C (±2 ˚C) immediately after collection	Immediate Analysis
	Flashpoint	NA	SW-846 1010A	Clear glass wide mouth jar 60 mL unless otherwise specified	None	10 days
	PCBs	NA	SW-846 8082A	One 8-ounce glass jar with Teflon®-lined cap. If oily, then use 4-ounce glass jar.	Store at 4 °C	14 days/

Notes:

*	Waste may be in solid or liquid form
ºC	degrees Celsius
EPA	U.S. Environmental Protection Agency
HDPE	High density polyethylene
mL	milliliter
NA	Not Applicable
SW-846	U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)
PCBs	Polychlorinated Biphenyls

ATTACHMENT 1

FIGURES



Reference Map

Legend

Approximate Site Boundary

Source: USGS 7.5-Minute Topographic Quadrangle Map
Warren, OH 1994

Warren Steel Holdings Site
4000 Mahoning Avenue
Warren, Trumbull County, Ohio

Figure 1
Site Location Map

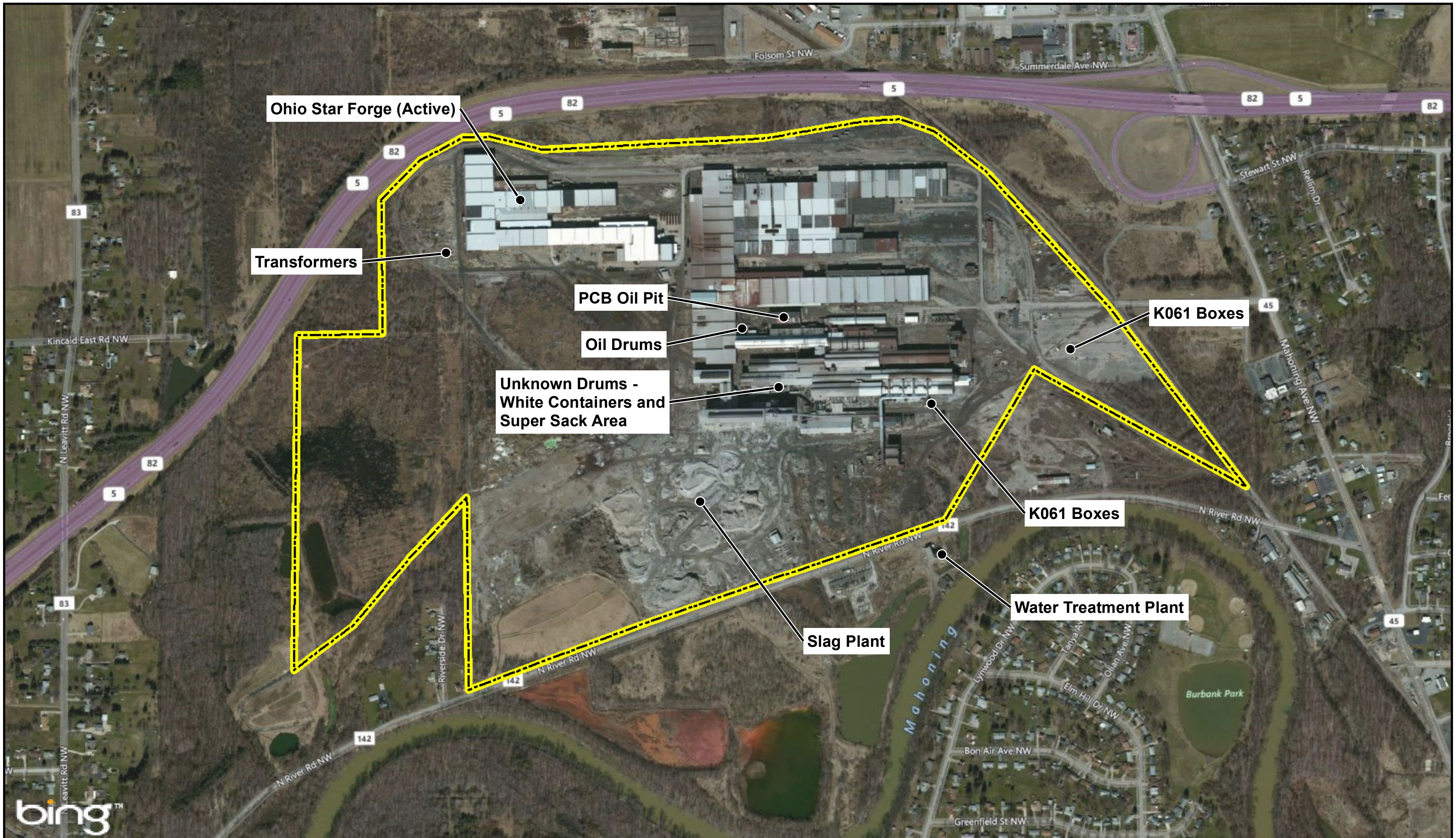
TETRA TECH

Prepared For: EPA | Prepared By: Tetra Tech, Inc.

File Path: G:\G\G9026-START IV\Ohio\Warren Steel Holdings Site\mxd\Fig1-SiteLocation.mxd

Date Saved: 1/9/2017 EPA Contract No.: EP-S5-13-01 TDD No.: S05-0001-1612-007

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum:WGS 1984
Units: Meter



Legend

Approximate Site Boundary

Source: Bing Maps Road 2013

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500 0 500

Feet

Warren Steel Holdings Site
4000 Mahoning Avenue
Warren, Trumbull County, Ohio

Figure 2
Site Layou Map

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Prepared For: EPA | Prepared By: Tetra Tech Inc.

File Path: G:\G\G9026-START IV\Ohio\Warren Steel Holdings Site\mxd\Fig2-SiteLayout.mxd

Date Saved: 2/14/2017 EPA Contract No.: EP-S5-13-01 TDD No.: S05-0001-1612-007

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

ATTACHMENT 2

TETRA TECH
STANDARD OPERATING PROCEDURES (SOPs)

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 3

Last Reviewed: June 2009

K Riesing	6-19-09
Quality Assurance Approved	Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap, obtained in powder detergent form and dissolved in water

Liquinox: Nonphosphate soap, obtained in liquid form for mixing with water

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992a. "Guide to Management of Investigation-Derived Wastes." Office of Solid Waste and Emergency Response. Washington D.C. EPA 9345.3-03FS. January.

EPA. 1992b. "RCRA Ground-Water Monitoring: Draft Technical Guidance." Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). http://www.ert.org/mainContent.asp?section=Products&subsection=List

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles
- Alconox or Liquinox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Isopropanol (pesticide grade)
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, general sampling equipment, and groundwater sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums (refer to Section 3.0).

Personnel decontamination procedures will be as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

4. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

5. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

6. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

7. Remove disposable gloves and place them in plastic bag for disposal.

8. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on site before drilling operations begin, between borings, and at completion of the project. Decontamination may be conducted on a temporary decontamination pad constructed at satellite locations within the site area in support of temporary work areas. The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Decontamination pads may be constructed of concrete, wood, or plastic sheeting, depending on the site-specific needs and plans. Wash waters and contaminated soil generated during decontamination activities should be considered contaminated and thus, should be collected and containerized for proper disposal.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned and placed on polyethylene sheeting on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

The drilling auger, bits, drill pipe, any portion of drill rig that is over the borehole, temporary casing, surface casing, and other equipment used in or near the borehole should be decontaminated by the drilling subcontractor as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Remove loose soil using shovels, scrapers, wire brush, etc.
4. Steam clean or pressure wash to remove all visible dirt.
5. If equipment has directly or indirectly contacted contaminated media and is known or suspected of being contaminated with oil, grease, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.
6. To the extent possible, allow components to air dry.
7. Wrap or cover equipment in clear plastic until it is time to be used.
8. All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING DOWNHOLE EQUIPMENT DECONTAMINATION

All soil sampling downhole equipment should be decontaminated before use and after each sample as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Prior to sampling, scrub the split-barrel sampler and sampling tools in a wash bucket or tub using a stiff, long bristle brush and Liquinox or Alconox solution.
4. After sampling, steam clean the sampling equipment over the rinsate tub and allow to air dry.
5. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
6. Containerize all water and rinsate; disposable single-use sampling equipment should also be containerized.
7. Decontaminate all equipment placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Wipe the tape and probe with a disposable Alconox- or Liquinox-impregnated cloth or paper towel.

4. If immiscible layers are encountered, the interface probe may require steam cleaning or washing with pesticide-grade isopropanol.

5. Rinse with deionized water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (isopropanol, methanol, or hexane) rinse, if applicable, or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (isopropanol, methanol, or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.

4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.

5. Containerize all water and rinsate.

2.6 GROUNDWATER SAMPLING EQUIPMENT

The following procedures are to be employed for the decontamination of equipment used for groundwater sampling. Decontamination is not necessary when using disposable (single-use) pump tubing or bailers. Bailer and downhole pumps and tubing decontamination procedures are described in the following sections.

2.6.1 Bailers

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Evacuate any purge water in the bailer.

4. Scrub using soap and water and/or steam clean the outside of the bailer.

5. Insert the bailer into a clean container of soapy water. Thoroughly rinse the interior of the bailer with the soapy water. If possible, scrub the inside of the bailer with a scrub brush.

6. Remove the bailer from the container of soapy water.

7. Rinse the interior and exterior of the bailer using tap water.

8. If groundwater contains or is suspected to contain oil, grease, PAH, PCB, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.

9. Rinse the bailer interior and exterior with deionized water to rinse off the tap water and solvent residue, as applicable.

10. Drain residual deionized water to the extent possible.

11. Allow components to air dry.

12. Wrap the bailer in aluminum foil or a clean plastic bag for storage.

13. Containerize the decontamination wash waters for proper disposal.

2.6.2 Downhole Pumps and Tubing

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Evacuate any purge water in the pump and tubing.

4. Scrub using soap and water and/or steam clean the outside of the pump and, if applicable, the pump tubing.

5. Insert the pump and tubing into a clean container of soapy water. Pump/run a sufficient amount of soapy water to flush out any residual well water. After the pump and tubing are flushed, circulate soapy water through the pump and tubing to ensure that the internal components are thoroughly flushed.

6. Remove the pump and tubing from the container.

7. Rinse external pump components using tap water.

8. Insert the pump and tubing into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).

9. If groundwater contains or is suspected to contain oil, grease, PAH, PCB, or other hard to remove organic materials, rinse the pump and tubing with pesticide-grade isopropanol.

10. Rinse the pump and tubing with deionized water to flush out the tap water and solvent residue, as applicable.

11. Drain residual deionized water to the extent possible.

12. Allow components to air dry.

13. For submersible bladder pumps, disassemble the pump and wash the internal components with soap and water, rinse with tap water, isopropanol (if necessary), and deionized water, and allow to air dry.

14. Wrap pump and tubing in aluminum foil or a clean plastic bag for storage.

15. Containerize the decontamination wash waters for proper disposal.

3.0 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) can include disposable single-use PPE and sampling equipment, soil cuttings, and decontamination wash waters and sediments. Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage will be provided in project-specific documents, or separate direction will be provided by the project manager. The following guidelines are provided for general use:

1. Assume that all IDW generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

2. Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.

3. Label IDW storage containers with the facility name and address, date, contents, company generating the waste, and an emergency contact name and phone number.

4. Temporarily store the IDW in a protected area that provides access to the containers and allows for spill/leak monitoring, sampling of containers, and removal following determination of the disposal method.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SEDIMENT AND SLUDGE SAMPLING

SOP NO. 006

REVISION NO. 4

Last Reviewed: May 2010

Quality Assurance Approved

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Date

1.0 BACKGROUND

Sediments generally are materials deposited in surface impoundments or in natural waterways such as lakes, streams, rivers, oceans, and sloughs, as well as particulate matter deposited on the marsh or wetland surface.

Sludges are semisolid materials ranging from dewatered solids to high-viscosity liquids. Sludges generally accumulate as residuals of water-bearing waste treatment or industrial process systems. Sludges typically accumulate in tanks, drums, impoundments, or other types of containment systems.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for sampling sediment in lakes, streams, and rivers as well as sludge in open drums and shallow tanks (3 feet deep or less) or surface impoundments that are largely accessible. Sludge sampling as it pertains to drums or other containers with smaller or less accessible openings is described in SOP 008..

1.2 SCOPE

This SOP applies to collection of sediment and sludge samples. It provides detailed procedures for gathering such samples with specific equipment.

1.3 DEFINITIONS

Bottom Dredge Grab Sampler: A clamshell-type metal scoop activated by a counter-lever latching system.

Composite Sample: A sample comprised of multiple grab samples representing a physical average of the total number of grab samples.

Discrete Sample: A sample comprised of a portion of material representing conditions present at a single unit of space and time.

Electronic Vibration Corer: A type of sampler that uses an electrically powered vibrating head, which vibrates vertically along the axis of the sampler to penetrate the sediment.

Gravity Corer: Metal tube with a tapered nosepiece on the bottom and a check valve on the top. The nosepiece reduces core disturbance during penetration. The check valve allows air and water to pass through the sampler during deployment and prevents sample loss (washout) during retrieval.

Hand Corer: Thin-wall tube or core barrel sampler. Some models include a tapered nosepiece, a “T” handle to facilitate sampler deployment and retrieval, and a check valve on top. Some models are available with extension handles, core barrel liners, core catchers, and sample extruders.

Transect Sampling: A series of samples collected at several locations oriented in a straight line.

1.4 REFERENCES

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AScI Corporation. 2002 “Collecting Sediment Samples by Vibracoring - Standard Operating Procedure.” On-line Address: http://www.vibracoring.com/files/CoreSOP.pdf

1.5 REQUIREMENTS AND RESOURCES

The selection of sampling equipment and procedures should be based on project objectives and site-specific conditions such as the type and volume of sediment or sludge to be sampled, sampling depth, and the type of sample required (disturbed or undisturbed). The selected sampling equipment should be constructed of inert materials that will not react with the sediment or sludge being sampled.

The following equipment may be required to sample sediment or sludge:

- Plastic sheeting
- Field logbook
- Stainless steel or disposable spoons or spatulas
- Stainless-steel or disposable scoop or trowel
- Stainless-steel bowls
- Telescoping or fixed-length pole/handle for scoop or trowel
- Hip waders, chest waders, or high rubber boots (depending on water depth)
- Boat (depending on water depth)
- Gravity corer
- Hand corer
- Sludge sampler
- Electronic vibration corer
- Bottom dredge sampler
- Stainless-steel or Teflon® tray
- Nylon rope
- Sample containers and labels
- Chain-of-custody and shipping materials
- Decontamination materials

2.0 PROCEDURES

This section provides general procedures for sampling sediment and sludge. Sections 2.1 through 2.5 specify the methods and equipment to be used for such sampling.

Sediment Sampling

Sediment can be sampled using a stainless-steel scoop or trowel (see Section 2.1), a hand corer (see Section 2.2), a gravity corer (see Section 2.3), an electronic vibration corer (see Section 2.4), or a bottom dredge grab sampler such as a Ponar grab sampler (see Section 2.5). Soil core catchers and brass, polycarbonate plastic, or Teflon® liners are often used with core samplers. A number of factors must be considered when selecting the type of sampler to be used. In streams, lakes, and impoundments, for instance, sediment is likely to demonstrate significant variations in composition.

For stream sediment sampling, the sampling location farthest downstream should be sampled first to avoid cross-contamination. Sediment samples collected in upstream and downstream locations should be obtained in similar depositional environments and, whenever possible, should be obtained from slow-moving pools. In addition, a sediment sample should be collected at approximately the same location as an associated aqueous sample. Aqueous samples should be obtained first to avoid collecting suspended particles that may result from sediment sampling. To avoid disturbing an area to be sampled, sampling locations in streams should always be approached from the downstream side.

Sediment samples collected from lakes and impoundments should also be collected at approximately the same locations as associated aqueous samples. As in stream sampling, aqueous samples should be collected first to avoid collecting suspended particles that may result from sediment sampling. Downgradient and background samples should be collected from similar depositional environments.

Typically, fine-grained sediments should be targeted as they have greater surface area available for adsorption of contaminants. In streams or rivers, low-velocity depositional areas (bends, areas behind obstructions, pooling areas) are preferred sampling locations. High velocity turbulent areas should be avoided, if possible. Samples may be collected at a single location, along a transect line, or as composite samples consisting of material from multiple grab samples.

Often times the top 10 centimeters (approximately top six inches) of sediment is targeted as the sample interval because most benthic organisms are found in this horizon. Sampling multiple locations can provide information on the horizontal distribution of contaminants in a given water body. A column of sediment can provide information on the vertical distribution of contaminants with depth. Sampling locations, the number of samples to be collected, sampling rationale, and sampling approach (grab, transect, composite, etc.) should be discussed in the project-specific plans.

Exact sampling locations should be documented in field logbooks or on data sheets with respect to fixed reference points or located using global positioning satellite (GPS) technology. In addition, the presence of rocks, debris, or organic material in the sludge or sediment to be sampled may preclude use of some types of samplers or require modification of sampling equipment.

Sludge Sampling

Sludge can often be sampled using a stainless-steel scoop or trowel (see Section 2.1). Frequently sludge forms when components with higher densities settle out of a liquid. When this happens, the sludge may still have an upper liquid layer above the denser components. When the liquid layer is sufficiently shallow, the sludge may be sampled using a hand corer (see Section 2.2). Use of the hand corer is preferred because it results in less sample disturbance. The hand corer also allows for the collection of an aliquot of the overlying liquid. This prevents drying or excessive oxidation of a sample before analysis. The hand corer may also be adapted to hold a brass, polycarbonate plastic, or Teflon® liner.

A gravity corer may also be used to collect samples of most sludges and sediments (see Section 2.3). A gravity corer is capable of collecting an undisturbed sample that profiles the strata present in a sludge or sediment. Depending on the weight of the gravity corer and the density of the sludge or sediment, a gravity corer may penetrate the material up to 30 inches. If the layer is shallow (less than 1 foot), gravity corer and hand corer penetration may damage any underlying liner or confining layer. In such situations, a Ponar grab sampler may be used because it is generally capable of penetrating only a few inches (see Section 2.4).

The following subsections specify methods for sediment and sludge sampling with specific equipment.

2.1 SAMPLING WITH A SCOOP OR TROWEL

Sediment or sludge samples may be collected with a simple scoop or trowel. This method is more applicable to sludge but can be used for sediments provided that the water is very shallow (a few inches). However, using a scoop or trowel may disrupt the water-sediment interface and cause substantial sample alteration. This method provides a simple, quick means of collecting a disturbed sample of sludge or sediment.

The following procedure can be used for sampling sludge or sediment with a scoop or trowel:

1. Place all sampling equipment on plastic sheeting next to the sampling location Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Carefully insert a pre-cleaned scoop or trowel into the sludge or sediment and remove the sample. In the case of sludge exposed to air, remove the first 2 to 4 inches of material before collecting the sample. In the case of collecting sediment with abundant debris or vegetation at the surface, carefully remove the debris (avoid disturbing the sediment to the extent possible) before collecting the sample.

4. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray. Record pertinent information in the field logbook (sample description, color, odor, texture, etc.) or in a field data collection form, if applicable. If samples are to be collected for VOC analysis, fill the appropriate VOC containers first before compositing the sample and logging the sample information.

5. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

6. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

7. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

8. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements. Samples are typically stored in coolers on ice before and during shipment.

9. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.2 SAMPLING WITH A HAND CORER

The hand corer, sometimes called a hand auger (see Figure 1), is used in the same situations and for the same materials as those described for the use of a scoop or trowel (see Section 2.1). However, the hand corer may be used to collect an undisturbed sample that can profile any stratification resulting from changes in material deposition thus allowing for sampling of the specific layer or layers of interest.

The exact type of hand corer will vary depending on the manufacturer, but the operational procedures discussed below are applicable to most types of hand corers. For example, some hand corers can be fitted with extension handles that allow collection of samples underlying a shallow layer of liquid. Most hand corers can be fitted with core catchers (Figure 1) to prevent sample loss upon retrieval and they can be adapted to hold liners, which are generally available in brass, polycarbonate plastic, or Teflon®. The type of hand corer and liner material should be chosen that will not compromise the intended analytical procedures.

The following procedure can be used for sampling sludge or sediment with a hand corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Position a pre-cleaned hand corer above the sampling location. If the sediment or sludge is non-cohesive, insert a core catcher into the end of the sampler. Carefully deploy the hand corer into the sludge or sediment using a smooth, continuous motion. Gently rotating the corer while it is being pushed may facilitate greater penetration and decrease core compaction.

4. When the hand corer is at the desired depth, rotate the “T” handle or the core barrel and retrieve the hand corer using a single, smooth motion. If the hand corer does not include a “T” handle, cap the top of the core barrel with your hand to provide additional suction during retrieval.

5. Remove the core catcher and nosepiece (if applicable) and extract the sample. Place the sample on a clean stainless-steel or Teflon® tray. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray. Record pertinent information in the field logbook (sample description, color, odor, etc.) or in a field data collection form, if applicable. If samples are to be collected for VOC analysis, fill the appropriate VOC containers first before compositing the sample and logging the sample information.

6. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

7. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

8. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

9. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements. Samples are typically stored in coolers on ice before and during shipment.

10. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.3 SAMPLING WITH A GRAVITY CORER

A gravity corer (see Figure 2) can collect essentially undisturbed samples to profile strata that develop in sediment and sludge during the deposition process. Depending on the sediment or sludge density and the gravity corer's weight, the sampler typically can penetrate the sediment or sludge to a depth of 30 inches, using the weight of the sampler to assist penetration. A gravity corer is lowered into the sediment from a fixed support (such as a boat or a portable tripod pole system).

Gravity corers should be used carefully in open drums, shallow tanks, or lagoons with liners. A gravity corer could penetrate beyond the sludge or sediment layer and damage the liner material.

The following procedure can be used for sampling sediment or sludge with a gravity corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Attach the required length of sample line to a pre-cleaned gravity corer. Braided, 3/16-inch nylon line is sufficient; however, 3/4-inch nylon line is easier to grasp during hoisting.

4. Secure the free end of the line to a fixed support to prevent accidental loss of the gravity corer.

5. Position the gravity corer above the sampling location. Allow the gravity corer to fall freely through the liquid and penetrate the sludge or sediment layer.

6. Retrieve the gravity corer with a smooth, continuous lifting motion. Do not bump the corer, as this may result in some sample loss.

7. Remove the core catcher and nosepiece (if applicable) from the gravity corer. Slide the sample out of the corer into a stainless-steel or Teflon® pan. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray. Record pertinent information in the field logbook (sample description, color, odor, etc.) or in a field data collection form, if applicable. If samples are to be collected for VOC analysis, fill the appropriate VOC containers first before compositing the sample and logging the sample information.

8. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

9. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

10. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

11. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements. Samples are typically stored in coolers on ice before and during shipment.

12. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.4 SAMPLING WITH AN ELECTRONIC VIBRATION CORE SAMPLER

Electronic vibration corers are commonly used core samplers because they can retrieve deep core samples in most types of sediment. For example, electronic vibration corers can be used from a boat to collect a sample from the shallow sea floor. Vibration corers typically are not appropriate for sludge sampling as they could penetrate beyond the sludge layer and damage the liner material of a container.

Vibration samplers have an electrically powered vibrating head, which vibrates vertically along the axis of the sampler to penetrate the sediment (Figure 3). The core barrel and liner are inserted into the head of the vibrator and the entire assembly is lowered into the water. A vibrating core sampler can penetrate compact sediments and collect core samples up to 10 meters long depending on the type of system used, the horsepower of the vibrating head, and weight of the sampler.

The two general types of vibrating core systems typically used include larger boat-deployed systems and portable pole systems. Larger vibrating core samplers require the use of an appropriately sized boat to maintain balance and provide adequate lift to break the head of the corer out of the sediment for sample retrieval (EPA 2001).

The following procedure can be used for sampling sediment with a submersible boat-deployed vibration corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location if working next to the shore or stream bank. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Securely attach the vibrating corer assembly to the winch cable.

4. Position the vibrating corer above the sampling location. Using the winch, suspend and lower the corer until the core tube contacts the bottom.

5. Begin vibration and continue penetration until the core tube is fully buried or refusal occurs. Care should be taken to keep the cable taught ensuring that the core tube is vertical. Turn off vibration when coring is completed.

6. Retrieve the vibration corer with the winch, using vibration only if extraction is difficult. Keep the core tube in a near vertical position once retrieved.

7. Remove the core catcher, nosepiece, and liner from the core tube. Cap the ends of the liner, label the liner to identify the location, sample number, time of collection, and date. Transfer the sample on-shore for further processing. Record pertinent information in the field logbook (sample description, color, odor, etc.) or in a field data collection form, if applicable.

8. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

9. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

10. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

11. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements. Samples are typically stored in coolers on ice before shipment.

12. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

The following procedure can be used for sampling sediment with a portable pole system vibration corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location if working next to the shore or stream bank. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Securely attach the retrieval lines to the core tube mounting cap.

4. Insert liner tube (core catcher end down) into mounting clamp and hand-tighten wing nuts evenly.

5. Insert desired length extension pole into mounting plate socket and secure with bolt and locknut. Slip flared lower end of the extension tube over the check-valve end of the core tube adapter while applying tension on the retrieval lines. Lower the system carefully until it contacts the bottom.

6. Press and vibrate the core tube until it is fully buried or refusal occurs. Note the depth of penetration by markings on the extension pole. Turn off vibration when coring is completed.

7. Disconnect the extension pole and manually retrieve the vibration corer with the retrieval lines or use a hand winch, if necessary. Keep the core tube in a near vertical position once retrieved.

8. Remove the core catcher, nosepiece, and liner from the core tube. Cap the ends of the liner, label the liner to identify the location, sample number, time of collection, and date. Transfer the sample on-shore for further processing. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray. Record pertinent information in the field logbook (sample description, color, odor, etc.) or in a field data collection form, if applicable. If samples are to be collected for VOC analysis, fill the appropriate VOC containers first before compositing the sample and logging the sample information.

9. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

10. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

11. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container.

12. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements. Samples are typically stored in coolers on ice before and during shipment.

13. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.5 SAMPLING WITH A BOTTOM DREDGE SAMPLER

Bottom dredge samplers are typically used to sample sediments that cannot be easily collected using trowels, scoops, or coring devices or in cases where large quantities of sample are desired. Bottom dredge samples are particularly effective when sampling from a boat where there are several feet of water above the sediment surface. Several types and sizes of dredges exist including the Peterson, Eckman, and Ponar. Dredges can be activated upon contact with the sediment or by using a "messenger" to close the buckets. The procedures discussed below are applicable to sampling with a Ponar dredge sampler. A Ponar grab sampler (see Figure 4) can be used to sample most types of sludges and sediments. A Ponar grab sampler is used by holding the grab sampler above the area to be sampled and lowering the grab sampler until it makes contact with the sediment. Its penetration depth into the sediment usually does not exceed several inches. The Ponar grab sampler, like other grab samplers, cannot collect undisturbed samples; therefore, this sampler should be used only after all overlying water samples have been collected.

The following procedure can be used for sampling sludge or sediment with a Ponar grab sampler:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Attach the required length of sample line to a precleaned Ponar grab sampler. Braided, 3/4-inch nylon line is recommended for ease in hoisting.

4. Measure the distance from the water surface or other reference point to the top of the sludge or sediment. Mark this measurement on the sample line. To avoid unnecessary disturbance of the sludge or sediment from lowering the Ponar grab sampler too quickly, it is recommended that a second mark be made on the sample line to indicate the proximity of the reference mark.

5. Open the Ponar sampler's jaws until they are latched. The jaws will be triggered if the Ponar sampler comes in contact with or is supported by anything other than the sample line. Tie the free end of the sample line to a fixed support.

6. Position the Ponar grab sampler above the sampling location. Lower the sampler until the proximity mark is reached. Then, slowly lower the Ponar grab sampler until it touches and penetrates the sludge or sediment.

7. Allow the sample line to slacken a few inches to release the latching mechanism that closes the sampler's jaws. As the jaws close, they scoop the sludge or sediment up into the sampler. More slack may be required when sampling in surface waters with strong currents.

8. Retrieve the sampler, open the jaws carefully, and release its contents into a stainless-steel or Teflon® tray. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray. Record pertinent information in the field logbook (sample description, color, odor, etc.) or in a field data collection form, if applicable. If samples are to be collected for VOC analysis, fill the appropriate VOC containers first before compositing the sample and logging the sample information.

9. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

10. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

11. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

12. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements. Samples are typically stored in coolers on ice before and during shipment.

13. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

FIGURE 1

HAND CORER

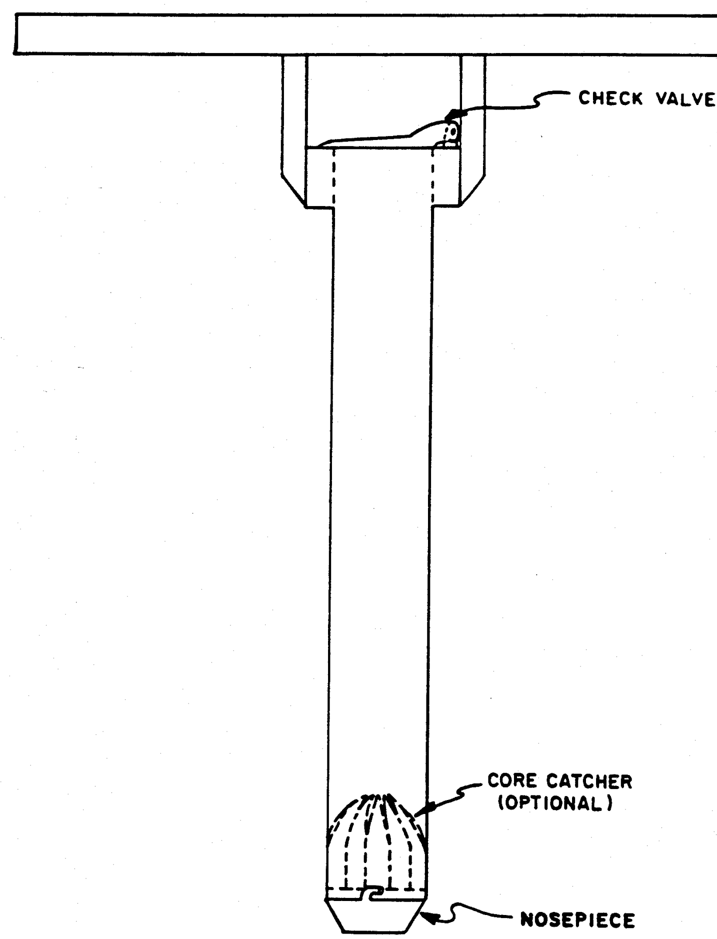


FIGURE 2

GRAVITY CORER

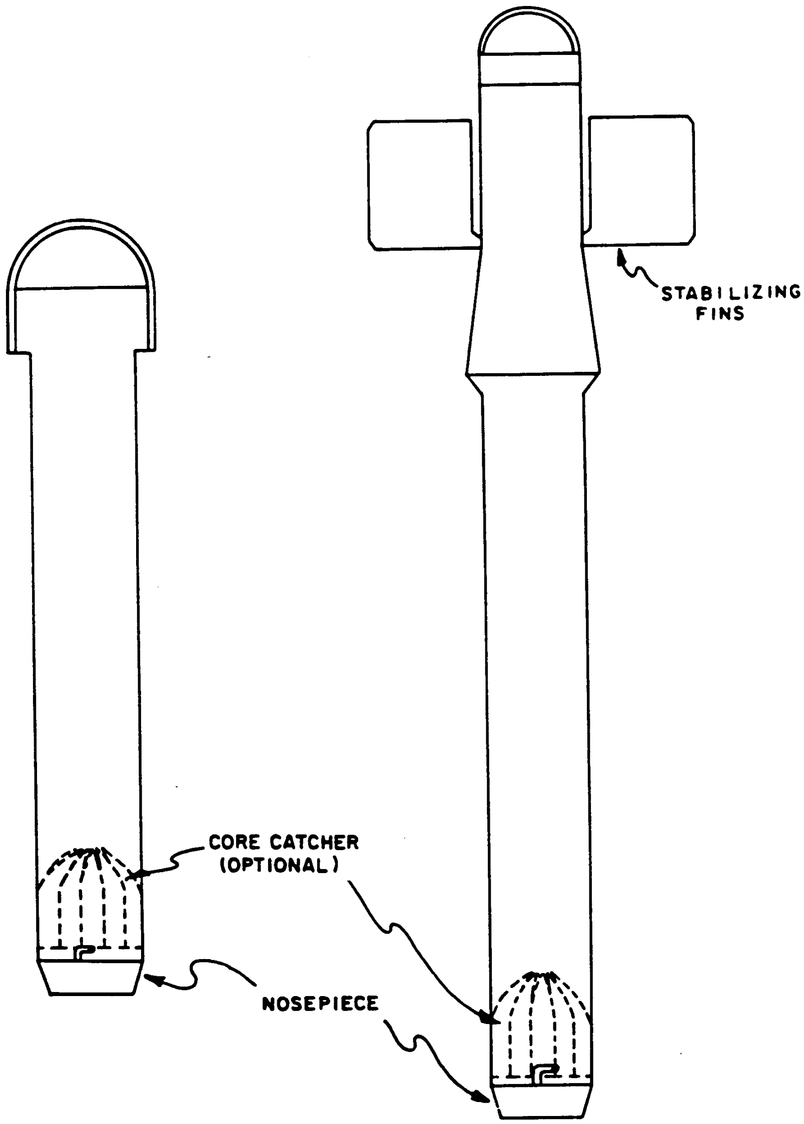


FIGURE 3

VIBRACORE SAMPLER

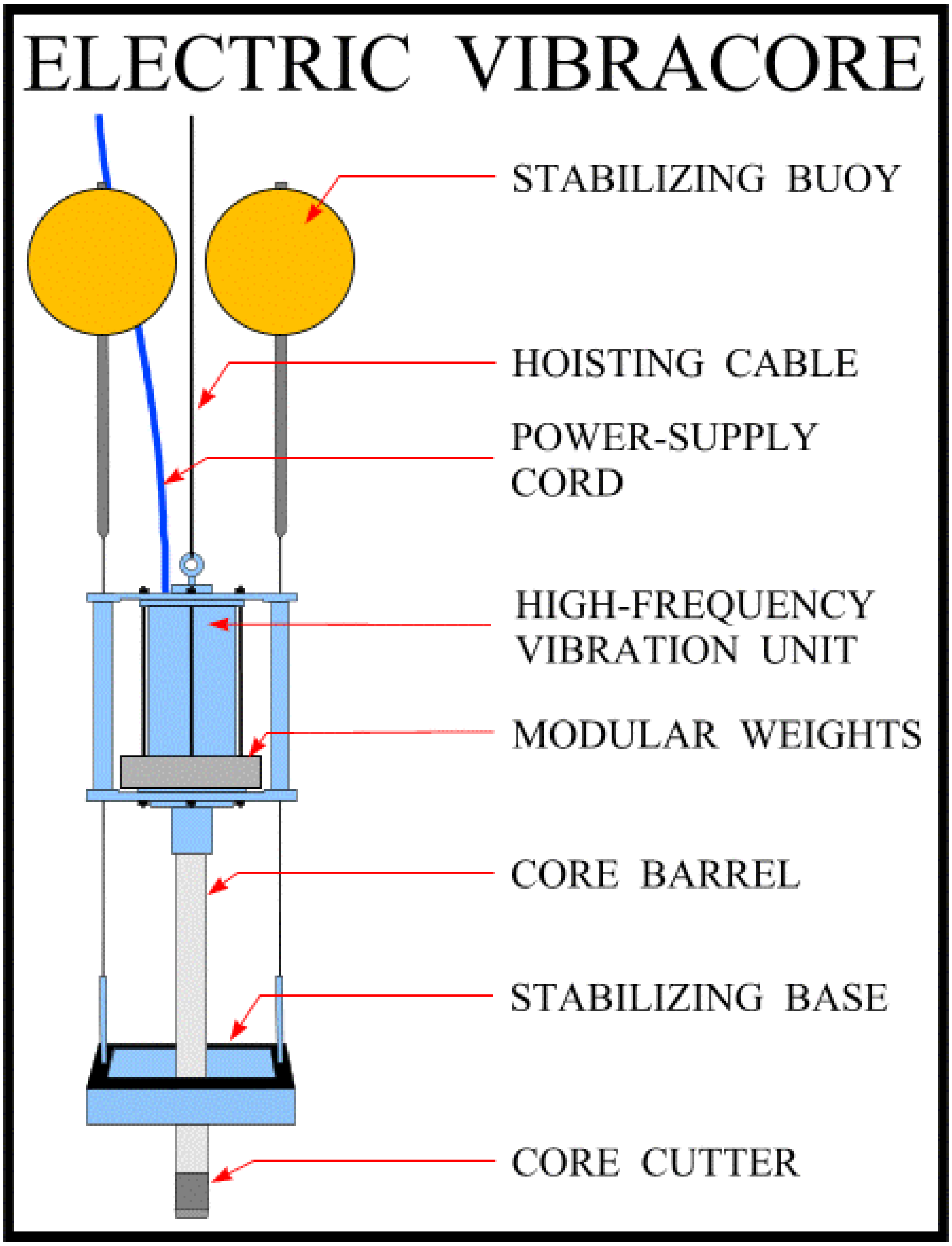
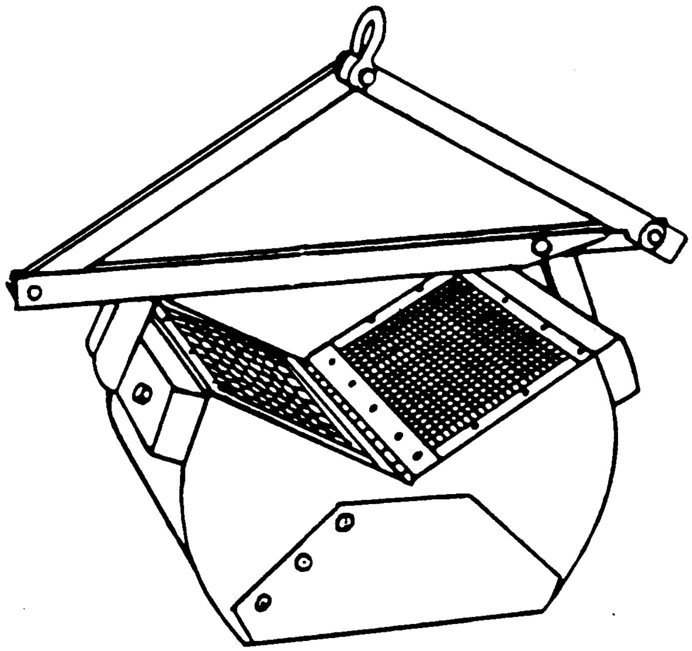


FIGURE 4

BOTTOM DREDGE GRAB SAMPLER



SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

CONTAINERIZED LIQUID, SLUDGE, AND SLURRY SAMPLING

SOP NO. 008

REVISION NO. 2

Last Reviewed: January 2000

RRiesing

Quality Assurance Approved

May 18, 1993

Date

1.0 BACKGROUND

Taking samples of liquid, sludge, and slurry from drums or other containers can present some unique problems. Manmade containers are typically closed. Containers are usually accessed either through small ports, manways, hatches, taps, or bungs. The size, shape, construction material, and location of a container may limit the types of equipment and methods that can be used to collect samples.

1.1 PURPOSE

This standard operating procedure (SOP) establishes procedures for sampling liquid, sludge, and slurry from containers.

1.2 SCOPE

Opening a closed container is a potentially hazardous task because toxic vapors and gases potentially could be released causing explosive reactions. Whenever containers that may contain hazardous materials are to be opened for sampling or any other reason, the sampling team should follow appropriate guidelines provided in site-specific sampling plans, health and safety plans, and the general guidelines in this SOP.

How containers are opened will depend on the purpose of the sampling; site conditions; the number, type, and condition of the containers; and the anticipated type of media to be sampled. As a result, no comprehensive procedures can be defined for sampling all types of containerized liquid, sludge, and slurry. This SOP provides general guidelines for dealing with problems that may be encountered while opening containers and sampling the media. General procedures are provided for sampling containerized liquid, sludge, and slurry using glass tubes and composite liquid waste samplers (COLIWASA).

1.3 DEFINITIONS

Bung Remover: A device used to open the lid of a drum.

COLIWASA: Composite liquid waste sampler used to sample free-flowing liquids and slurries in containers.

Hazardous Samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR); ground shipments should be packaged and labeled in accordance with the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR, *Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180). See SOP No. 019 (Packaging and Shipping Samples) for additional information.

Photoionization Detector (PID): A direct-reading air monitoring instrument used to measure organic vapors based on the principle of photoionization. Examples of PIDs include the HNu and the Microtip.

Flame Ionization Detector (FID): A direct-reading, air monitoring instrument used to measure organic vapors based on the principle of flame ionization. An example of an FID is an organic vapor analyzer (OVA).

1.4 REFERENCES

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1.5 REQUIREMENTS AND RESOURCES

Depending on container specifications and the method selected for collecting samples, the following equipment may be required to sample liquid, sludge, and slurry from containers:

- Glass tubes
- FID or PID
- Bung remover
- COLIWASA
- Rubber stopper
- Stainless-steel spatula
- Chain-of-custody forms and shipping materials
- Sample containers and labels
- Appropriate personal protective equipment (PPE)
- A permanent marker for labeling containers

2.0 PROCEDURES

Opening a closed container may potentially release toxic vapors and gases that could cause an explosive reaction. The decision to open a container to sample the contents should be made only after other potentially less dangerous site characterization methods, such as geophysical investigations or sampling of noncontainerized media, have been ruled out. In some cases, however, sampling the contents of the container may be necessary for use in legal cases or for other reasons.

Until the container contents are characterized, the sampling team should assume that materials in unlabeled containers are hazardous. Labeled containers such as 55-gallon drums are often reused and can be mislabeled. The sampling team should exercise caution when working with or around containers.

When the decision to open a container has been made, the sampling team must assess potential exposure risks. Risk factors include the number, type, and condition of containers; site conditions that could prevent a container from being safely and efficiently opened; and the anticipated contents of the container. Based on this information and based on the scope of work for the project, the sampling team should consist of at least two persons and develop a safe procedure for opening the container and sampling its contents.

Sampling team members must wear appropriate PPE when opening and sampling containers. In some cases, particularly when the contents of the container are not positively known the sampling team should consider using a remote drum opener to open closed containers. The choice of remote drum opening methods depends on the number of drums to be opened, their contents, and their physical condition. One type of remote drum opener uses hydraulic pressure to push a non-sparking metal spike into either the side or top of the drum.

After the container is opened, headspace gases should be monitored using an intrinsically safe monitoring instrument. At a minimum, a preliminary check using appropriate air-monitoring instruments should be conducted to help determine the level of PPE required and the appropriate sampling method.

Layering or stratification of any material left undisturbed over time is likely. Agitation of the container to homogenize the material can be difficult and is undesirable if the contents of the container are not known. The sampling team must ensure that samples represent the entire contents of the container, not just the contents of a single layer.

For sampling liquid and sludge in drums or other small to medium-sized containers, the glass tube sampling method is recommended. Tubes are available that collect a sample from the full depth of a drum and retain it until placement in a sample container. This sampling method is discussed in detail in Section 2.1. The COLIWASA is widely used to sample containerized and free-flowing liquids and slurries in drums and other containers. It also is used for sampling immiscible liquid-phase waste. Use of the COLIWASA is outlined in Section 2.2.

2.1 SAMPLING USING GLASS TUBES

Glass tubes can be used to sample liquids and sludge in containers such as 55-gallon drums. Glass tubes designed for this purpose are normally 122 centimeters (4 feet) long and have an inside diameter of 0.6 to 1.6 centimeters (0.24 to 0.63 inches). Glass tubes with larger inside diameters are used for sampling viscous liquids. When sampling is completed, the glass tubes can be broken and disposed of in the container just sampled. This eliminates the need for cleanup and disposal. However, if disposal of the tube by breaking in into the drum interferes with plans for the removal of the container contents, other disposal techniques should be evaluated.

The glass tube method is a quick, relatively inexpensive way of sampling containerized liquid and sludge. The major disadvantage of this method is that some sample loss may occur when sampling less viscous liquids. Splashing of such liquids also can expose sampling team members to potentially hazardous materials. For this reason, appropriate PPE, such as a butyl rubber apron, a face shield, safety glasses, respirators, boot covers, and gloves may be needed when using the glass tube method.

The procedures for sampling liquids and sludge using the glass tube method are given below. Following these procedures, cautionary notes are provided.

2.1.1 Sampling Containerized Liquids Using a Glass Tube

The following procedures can be used to sample containerized liquids using a glass tube:

1. Place all sampling equipment on a plastic sheet next to the container to be sampled. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Preservation, Holding Time, and Container Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Wear appropriate PPE. Use a PID or FID to monitor airborne organic vapors and gases in the breathing zone. In most cases, a PID is preferred because it is intrinsically safe, although an FID may be appropriate in some cases.

4. Record in the field logbook all exterior container markings, special conditions, and the type of opening through which the sample will be collected.

5. Using a permanent marker, make a unique identifying number on the container.

6. Locate an existing opening or bung hole in the container, if possible.

7. Using nonsparking tools, a bung remover, or a remote drum opener, carefully remove the cover or bung from the container.

8. Slowly insert a glass tube to a level slightly above the bottom of the container or until a solid layer is encountered. If layering or stratification of the liquids in the container is expected, the glass tube should be inserted at a rate that permits the liquid level inside and outside the tube to be about the same. Keep at least 30 centimeters (12 inches) of the glass tube above the top of the container.

9. Allow the liquid in the container to reach its natural level in the glass tube.

10. Cap the top of the glass tube with a safety-gloved thumb or a rubber stopper.

11. Remove the capped glass tube from the container, look for different layers, and insert the uncapped end into the labeled sample container.

12. Release the thumb or rubber stopper from the glass tube to allow the liquid to drain into the sample container.

13. Fill the sample container to approximately 90 percent of its capacity. Repeat steps 8 through 12 if more volume is needed to fill the sample container.

14. Dispose of the glass tube in an appropriate manner.

15. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container. All containerized liquid samples should be evaluated in accordance with the "Sample Classification" section of SOP No. 019 (Packaging and Shipping Samples) to determine if they are hazardous samples; hazardous samples should be packaged and shipped in accordance with Dangerous Goods Regulations.

16. Replace the bung in the container or seal the opening in the container with plastic.

17. Complete all chain-of-custody forms and record sampling activities in the field logbook. Unless the sample will be analyzed at the site, complete all sample packaging requirements in accordance with SOP No. 019, Packaging and Shipping Samples.

2.1.2 Sampling Containerized Sludge Using a Glass Tube

The following procedures can be used to sample containerized sludge using a glass tube.

1. Follow steps 1 through 7 for sampling containerized liquids using a glass tube (see Section 2.1.1).

2. Slowly insert a glass tube to a level slightly above the top of the sludge layer. Keep at least 30 centimeters (12 inches) of the glass tube above the top of the container.

3. Allow the liquid in the container to reach its natural level in the glass tube.

4. Gently push the glass tube into the sludge layer at the bottom of the container.

5. Cap the top of the glass tube with a safety-gloved thumb or a rubber stopper.

6. Remove the capped glass tube from the container and insert the uncapped end into the labeled sample container (for example, a wide-mouthed, 8-ounce glass jar).

7. Release the thumb or rubber stopper from the glass tube to allow the material to drain into the sample container. If necessary, the sludge sample in the bottom of the tube may be dislodged using a stainless-steel spatula.

8. Fill the container to approximately 90 percent of its capacity. Repeat steps 2 through 7 if more volume is needed to fill the sample container.

9. Dispose of the glass tube in an appropriate manner.

10. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container. All containerized sludge samples should be evaluated in accordance with the "Sample Classification" section of SOP No. 019 (Packaging and Shipping Samples) to determine if they are hazardous samples; hazardous samples should be packaged and shipped in accordance with Dangerous Goods Regulations.

11. Replace the bung in the container or seal the opening in the container with plastic.

12. Complete all chain-of-custody forms and record sampling activities in field logbook. Unless the sample will be analyzed at the site, complete all sample packaging requirements in accordance with SOP No. 019, Packaging and Shipping Samples.

2.1.3 Cautionary Notes

Because there is potential for problems, interferences, and accidents to occur during sampling of containerized liquids and sludges, the following cautionary notes are provided.

1. If you observe any reaction when the glass tube is inserted into the container (for example, violent agitation, smoke, light, or heat), leave the area immediately.

2. If the glass tube becomes cloudy or smoky after inserting it into the container, hydrofluoric acid may be present. Glass tube sampling is inappropriate in this circumstance. Instead, use a comparable length of rigid plastic tubing to collect the sample and transfer the sample to an appropriate sample container.

3. When solid material is encountered in a container (either a floating layer or bottom sludge), use the sludge sampling procedure to collect a sample of the material.

Alternatively, if the container opening is sufficiently large, the material may be sampled with a disposable scoop attached to a disposable wooden or plastic rod.

2.2 SAMPLING USING THE COLIWASA

The COLIWASA is used to collect samples of containerized or free-flowing liquid and slurry in drums and other containers. The COLIWASA is commercially available; however, it can be assembled from a variety of materials, including polyvinyl chloride (PVC), glass, or Teflon®. It consists of a 152-centimeter (5-foot) -long tube with an inside diameter of 4 centimeters (1.6 inches). The tube has a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the COLIWASA by raising and lowering the neoprene stopper.

The recommended COLIWASA design is shown in Figure 1. The design may be modified to meet the needs of a sampling situation. The major drawbacks of using a COLIWASA involve decontamination and cost. The COLIWASA is difficult to decontaminate in the field and has a high cost compared to glass tubes. However, disposable COLIWASAs are available and are a viable alternative. The COLIWASA's major advantage is its ability to collect samples that accurately represent a multiphase waste.

The following procedure can be used for sampling containerized liquid or slurry using the COLIWASA:

1. If a commercial COLIWASA is unavailable, select the material to make the COLIWASA (for example, PVC, glass, or Teflon®). Assemble the sampler as shown in Figure 1. Check the COLIWASA to make sure it is functioning properly. Adjust the locking mechanism so that the neoprene stopper provides a thin closure.

2. If using a nondisposable COLIWASA, clean the COLIWASA according to procedures specified in SOP No. 002, General Equipment Decontamination. Place all sampling equipment on a plastic sheet next to the container to be sampled. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Preservation, Holding Time, and Container Requirements.

3. Affix a completed sample container label to the appropriate sample container.

4. Wear appropriate PPE. Use a PID or FID to monitor airborne organic vapors and gases in the breathing zone. In most cases a PID is preferred because it is intrinsically safe, although an FID may be appropriate in some cases.

5. Record in the field logbook all exterior container markings, special conditions, and the type of opening through which the sample will be collected.

6. Using a permanent marker, make a unique identifying number on the container.

7. Locate an existing opening or a bung hole in the container, if possible.

8. Using nonsparking tools, a bung remover, or a remote drum opener, carefully remove the cover or bung from the container.

9. Place the COLIWASA in the open (sampling) position. The stopper rod handle should be in the T position, and the rod should be pushed down until the handle rests against the locking block.

10. Slowly lower the COLIWASA into the liquid or slurry at a rate that permits the levels of the liquid or slurry inside and outside the COLIWASA tube to be about the same. If the liquid or slurry level in the COLIWASA tube is lower than that outside the COLIWASA tube, the sampling rate is too fast and will produce a nonrepresentative sample.

11. When the stopper reaches the bottom of the container, push the COLIWASA tube downward against the stopper to close it. Lock the COLIWASA tube in the closed position by turning the stopper rod handle from the T position until it is upright and one end rests tightly against the locking block.

12. Remove the COLIWASA tube from the container and wipe it with a disposable cloth.

13. Slowly discharge the sample into the labeled sample container. To do this, slowly pull the lower end of the stopper rod handle away from the locking block while the lower end of the COLIWASA tube is positioned in the sample container.

14. Ensure that a Teflon® liner is present in the sample container cap. Secure the cap tightly on the sample container. All containerized liquid and slurry samples should be evaluated in accordance with the "Sample Classification" section of SOP No. 019 (Packaging and Shipping Samples) to determine if they are hazardous samples; hazardous samples should be packaged and shipped in accordance with Dangerous Goods Regulations.

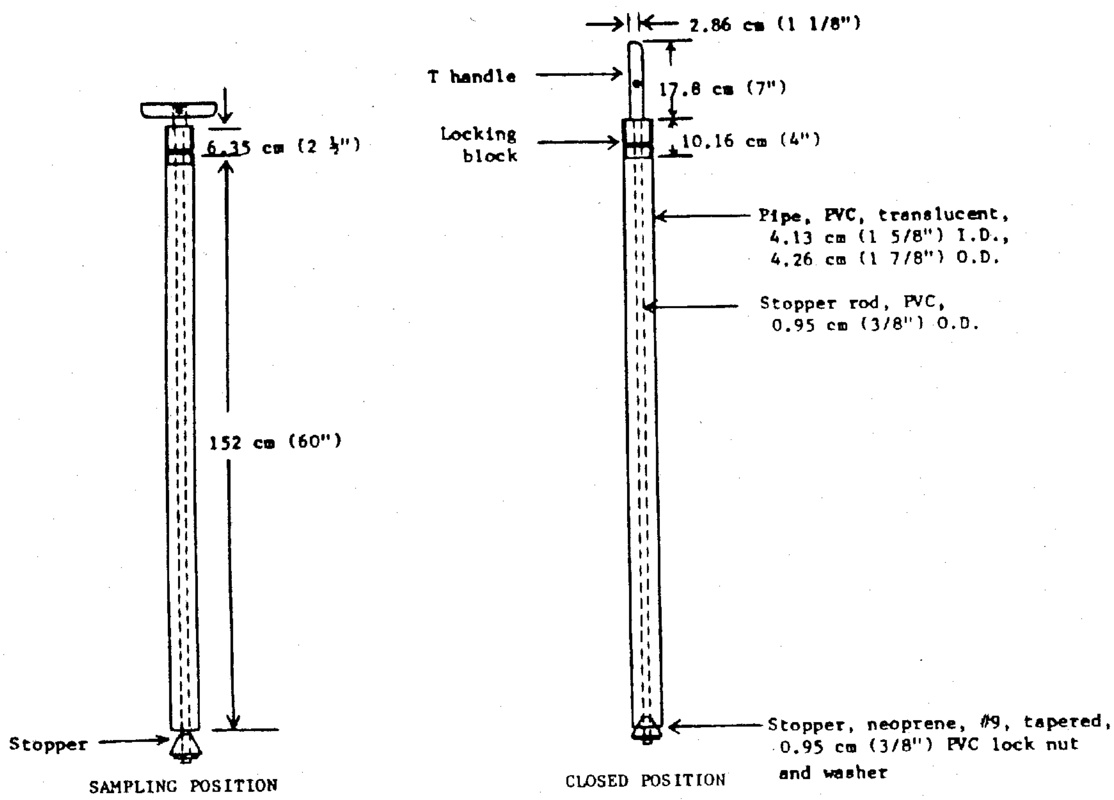
15. Replace the bung in the container or seal the opening in the container with plastic.

16. Complete all chain-of-custody forms and record sampling activities in the field logbook. Unless the sample is to be analyzed at the site, complete all sample packaging requirements in accordance with SOP No. 019, Packaging and Shipping Samples.

17. If a disposable COLIWASA was used, dispose of the device in an appropriate manner. Otherwise, unscrew the stopper rod handle of the COLIWASA tube and disengage the locking block. Decontaminate the COLIWASA tube on site or store the contaminated parts in a plastic storage tube for subsequent decontamination using the procedures in SOP No. 002, General Equipment Decontamination.

FIGURE 1

COLIWASA



SOP APPROVAL FORM

TETRA TECH, INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 7

Last Reviewed: November 2014

______________________________	November 24, 2014
Quality Assurance Approved	Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. This standard operating procedure (SOP) describes procedures for packaging and shipping samples. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples.

1.1 PURPOSE

This SOP establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Contract Laboratory Program Guidance for Field Samplers." Procedures described in this SOP should be followed for all routine sample packaging and shipping. If procedures are to be modified for particular contract- or laboratory-specific requirements, modified procedures should be clearly described in site-specific plans such as work plans, field sampling plans (FSPs), or quality assurance project plans (QAPPs). Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already in the appropriate sample jars and that the sample jars are labeled.

This SOP does not cover the packaging and shipment of Dangerous Goods or Hazardous Materials. The shipment of Dangerous Goods (by air) and Hazardous Materials (by ground) requires specialized training. If you have NOT received this training in the last two years, you are NOT qualified to package or ship these materials and may be personally liable for any damages or fines. Contact one of Tetra Tech's shipping experts for assistance. Instructions to access the training course, shipping experts and health and safety (H&S) contacts, and general information on packaging and shipping hazardous substances and dangerous goods can be obtained by checking the links provided in Section 1.4 (References).

1.2 SCOPE

This SOP applies to packaging and shipping of environmental and nonhazardous samples. This SOP does not address shipping dangerous goods or hazardous materials.

1.3 DEFINITIONS

Airbill: An airbill is a shipping form (such as a FedEx shipping form) acquired from the commercial shipper and is used to document shipment of the samples from the sampler to the designated analytical laboratory (see Figure 1).

Custody-of-Custody form: A chain-of-custody form is used to document the transfer of custody of samples from the field to the designated analytical laboratory (see Figure 2). The chain-of-custody form is critical to the chain-of-custody process and is used to identify the samples in each shipping container to be shipped or delivered to the laboratory for chemical or physical (geotechnical) analysis (see Figure 3).

Custody seal: A custody seal is a tape-like seal and is used to indicate that samples are intact and have not been disturbed during shipping or transport after the samples have been released from the sampler to the shipper (see Figure 4). The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping (see Figure 5).

Environmental samples: Environmental samples include drinking water, most groundwater and surface water, soil, sediment, treated municipal and industrial wastewater effluent, indoor and ambient air, nonhazardous bulk materials, soil gas, dust, asbestos, and biological specimens. Environmental samples typically contain low concentrations of contaminants and, when handled, require only limited precautionary procedures.

Field Blank: A field blank is any blank sample that is packaged and shipped from the field. Each field blank is assigned its own unique sample number. Field blanks include trip blanks, rinse blanks, and equipment blanks, all intended to assess potential cross-contamination. For example, a trip blank checks for contamination during sample handling, storage, and shipment from the field to the laboratory.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample and **do not** need to be packaged and shipped in accordance with the International Air Travel Association's (IATA's) "Dangerous Goods Regulations" (DGR) or U.S. Department of Transportation's (U.S. DOT's) "Hazardous Materials Regulations" (HMR) defined in Title 49 Code of Federal Regulations (CFR).

The following definitions are provided to further distinguish environmental and nonhazardous samples from dangerous good and hazardous samples:

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 2014).

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the HMR.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in 49 CFR 172.101 and its quantity, in one package, equals or exceeds the reportable quantity (RQ) listed in Table 1 to Appendix A of 49 CFR 172.101.

1.4 REFERENCES

General Awareness, H&S contacts, and course training information" click here. (Tetra Tech, Inc., EMI Operating Unit. Intranet) Available on-line at: https://int.tetratech.com/sites/EMI/hs/Pages/Dangerous-Goods-Shipping.aspx

International Air Transport Association (IATA). 2014. "Dangerous Goods Regulations. 2014." For sale at: http://www.iata.org/publications/Pages/standards-manuals.aspx. Updated annually, with new edition available late in year.

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EPA. 2011. "Contract Laboratory Program Guidance for Field Samplers." EPA 540-R-09-03. Available on-line at: http://www.epa.gov/oerrpage/superfund/programs/clp/download/sampler/CLPSamp-01-2011.pdf. January.

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping samples require the following:

- Coolers (insulated ice chest) or other shipping containers appropriate to sample type
- Ice
- Bubble wrap or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Large plastic garbage bags for lining the cooler
- Temperature blank sample bottle filled with distilled water can be included in the cooler if appropriate to sample type

- Trip blank samples used to check for volatile contamination during sample handling in the field and shipment from field to laboratory should be included in the cooler if volatile organic compounds are requested for analysis. Also see Field Blank under definitions.

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and environmental samples.

2.1 PACKAGING SAMPLES

After they have been appropriately containerized and labeled, environmental samples should be packaged as described in this section. This section covers procedures for packing samples for delivery by commercial carrier (air or ground) and hand delivery of environmental samples (by employee or courier), as well as shipping asbestos and air quality samples. Note that these instructions are general; samplers also should be aware of client-specific requirements concerning the placement of custody seals or other packaging provisions.

2.1.1 Packaging Samples for Delivery by Commercial Carrier (Air or Ground)

Samples shipped by commercial carriers should be packed for shipment using the following procedures and in compliance with all carrier requirements:

Preparing the sample:

1. Allow a small amount of headspace in all bottles, or as instructed by the laboratory (except volatile organic compound [VOC] containers with a septum seal) to compensate for any changes in pressure and temperature during transfer.
2. Be sure the lids on all bottles are tight (will not leak). Lids maybe taped or sealed with custody seals as added protection or as required.
3. Place sample containers in resealable plastic bags.

Preparing the cooler:

1. Secure and tape the drain plug of the cooler with fiber or duct tape.
2. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.
3. Wrap the sample containers in bubble wrap or line the cooler (bottom and sides) with a cushioning material to prevent breakage of bottles or jars during shipment.
4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C (± 2 °C). Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. If required, include one temperature blank (a sample bottle filled with distilled water) per cooler.

5. For volatile organic analysis (VOA) samples only, include one trip blank for VOA analysis per shipment matrix in each cooler.
6. Fill all remaining space between the bottles or jars with bubble wrap.
7. Securely fasten the top of the large garbage bag with tape (preferably plastic electrical tape).
8. If more than one cooler is being shipped, mark each cooler as "1 of 2," "2 of 2," and so forth.
9. Place the chain-of-custody forms (see Figure 2) into a resealable plastic bag, and tape the bag to the inner side of the cooler lid (see Figure 3). If you are shipping more than one cooler, copy the chain-of-custody form so that there is one copy of all forms in each cooler. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler. Tape any instructions for returning the cooler to the inside of the lid.
10. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once.
11. Place two signed custody seals (see Figure 4) on opposite sides of the cooler, ensuring that each one covers the cooler lid and side of the cooler (see Figure 5; note that in contrast to the figure, the seals should be placed on the opposite sides of the cooler and offset from each other, rather than directly across from each other as shown in Figure 5). Place clear plastic tape over the custody seals so that the cooler cannot be opened without breaking the seal.
12. Shipping containers must be marked "THIS END UP." Arrow labels, which indicate the proper upward position of the container, may also be affixed to the container (see Figures 3 and 5). A label containing the name, phone number, and address of the shipper should be placed on the outside of the container (Federal Express [FedEx] label) (see Figure 1).
13. Ship samples overnight using a commercial carrier such as FedEx.

2.1.2 Hand Delivery of Environmental Samples (by Employee or Courier)

Samples hand-delivered to the laboratory should be packed for shipment using the following procedures:

Preparing the sample:

1. Bottles can be filled completely with sample (required for VOC containers with a septum seal).
2. Be sure the lids on all bottles are tight (will not leak).

Preparing the cooler:

1. Secure and tape the drain plug of the cooler with fiber or duct tape.
2. Wrap the sample containers in bubble wrap and/or line the cooler (bottom and sides).
3. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. If required, include one temperature blank (a sample bottle filled with distilled water) per cooler.
4. For VOA samples only, include one trip blank for VOA analysis per shipment matrix in each cooler.
5. If more than one cooler is being shipped, mark each cooler as "1 of 2," "2 of 2,"and so forth.

6. Place chain-of-custody form (see Figure 2) in a resealable plastic bag and tape to the inside of the cooler lid, close the lid, seal with custody seals, and transfer the cooler to the courier (see Figure 3). Alternatively, when samples will be delivered directly to the laboratory, close the cooler and hand-deliver it with the chain-of-custody form. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler.
7. Include any instructions for returning the cooler to the inside of the lid.
8. Place two signed custody seals (see Figure 4) on opposite sides of the cooler, ensuring that each one covers the cooler lid and side of the cooler (see Figure 5, note that the seals should be placed on the opposite sides of the cooler and offset from each other, rather than directly across from each other as shown in Figure 5). Place clear plastic tape over the custody seals so that the cooler cannot be opened without breaking the seal.
9. Shipping containers must be marked “THIS END UP,” and arrow labels, which indicate the proper upward position of the container should be affixed to the container (see Figures 3 and 5).

2.1.3 Shipping Asbestos Samples

Asbestos samples shipped by commercial carriers should be packed for shipment using the following procedures and in compliance with all carrier requirements:

1.` Place each asbestos sample in a small resealable plastic bag. Place the bags of asbestos samples in a large resealable plastic bag.
2. Select a rigid shipping container (FedEx box) and pack the cassettes upright in a noncontaminating, nonfibrous medium such as a bubble pack to prevent excessive movement during shipping.
3. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.
4. Affix custody seals to the top of the cassettes or outer sample bag so that the bags cannot be opened without breaking the seal.
5. Insert the chain-of-custody form in the box. Include a shipping bill and a detailed listing of samples shipped, their descriptions and all identifying numbers or marks, sampling data, shipper’s name, and contact information.
6. Ship bulk samples in a separate container from air samples. Bulk samples and air samples delivered to the analytical laboratory in the same container will be rejected.
7. For each sample set, designate which are the ambient samples, which are the abatement area samples, which are the field blanks, and which is the sealed blank if sequential analysis is to be performed.
8. Hand-carry samples to the laboratory in an upright position if possible; otherwise, choose that mode of transportation least likely to jar the samples in transit.
9. Address the package to the laboratory sample coordinator by name when known and alert him or her of the package description, shipment mode, and anticipated arrival as part of the chain-of-custody and sample tracking procedures. This information will also help the laboratory schedule timely analysis for the samples when they are received.

2.1.4 Shipping Air Samples

Packaging and shipping requirements for air samples vary depending on the media used to collect the samples and the analyses required. Sampling media typically include Summa canisters and Tedlar bags for whole air samples, filters for metals and particulate matter, and sorbent tubes for organic contaminants. This section of the SOP provides general guidelines for packaging and shipping air samples collected using these media. The project FSP or QAPP should also be reviewed for any additional project-specific requirements or instructions.

Summa Canister Samples

1. Close the canister valve by tightening the knob clockwise or flipping the toggle switch. Replace the brass cap on the canister inlet.
2. If a flow controller was used to collect the air sample over a specified time interval, the flow controller should be removed before replacing the brass cap.
3. Fill out the sample tag on the canister with the sample number and the date and time of collection. Include the identification number of the flow controller on the sample tag if one was used. Make sure the information on the sample tag matches the chain-of-custody form.
4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final Summa canister vacuum readings; Summa canister identification number; and flow controller identification number.
5. Package the Summa canister (and flow controller) in its original shipping box with the original packaging material. Tape the box shut and apply custody seals if required. Note: Summa canisters should never be packaged with ice.
6. Summa canister shipments typically include several canisters, and may include more than one shipping box. The chain-of-custody form for the shipment should be sealed within one of the shipping boxes.
7. Ship the samples by a method that will meet the holding time. Summa canister samples should be analyzed within 30 days of sample collection.

Tedlar Bag Samples

1. Close the Tedlar bag by tightening the valve clockwise.
2. Fill out the label on the bag with the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.
3. Complete the chain-of-custody form.
4. Package the Tedlar bag in a shipping box with appropriate packing material. Multiple bags can be packaged in the same box. Tape the box shut and apply custody seals if required. Note: Tedlar bag samples should not be cooled or packaged with ice.
5. Tedlar bag shipments may include more than one shipping box. The chain-of-custody form for the shipment should be sealed within one of the shipping boxes.

6. Ship the samples using priority overnight delivery. Tedlar bag samples should be analyzed within 3 days of sample collection.

Filter Cassette Samples

1. Disconnect the filter cassette from the air sampling pump and replace the plastic caps on the inlet and outlet openings.
2. Attach a label to the sample that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.
3. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.
4. Package the filter cassettes in a shipping box (such as a FedEx box). Use an appropriate packing material (such as bubble wrap) to separate the samples and prevent damage.
5. Place the chain-of-custody form within the box, seal the box, and apply custody seals if required. Filter cassette samples typically do not need to be cooled, but check the FSP or QAPP for project-specific requirements.
6. Ship the samples by a method that will meet the holding time.

Sorbent Tube Samples

1. Disconnect the sample tube from the air sampling pump and seal both ends of the tube with plastic caps.
2. Complete a sample label that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.
3. If the tube is small and the label cannot be attached to the tube, the tube can be placed in a small sealable plastic bag and the label can be attached to the bag or placed inside the bag with the tube.
4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.
5. Packaging requirements for the sample tubes will depend on the analysis required, and the sampler should check the FSP or QAPP for project-specific requirements (for example, tubes may need to be wrapped in aluminum foil to prevent exposure to light). Packaging containers and methods include (1) shipping boxes (as described under filter cassette samples), (2) small sample coolers filled with double-bagged ice, and (3) small sample coolers filled with blue ice.
6. Place the chain-of-custody form within the box or container, seal the box or container, and apply a custody seal if required.
7. If coolers are used for shipping, tape instructions for returning the cooler to the inside of the lid.
8. Ship the samples by a method that will meet the holding time.

Polyurethane Foam (PUF) Tube Samples

1. Disconnect the PUF tube from the air sampling pump and wrap the tube in aluminum foil.
2. Attach a label to the wrapped sample tube that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.
3. Wrap the PUF tube in bubble wrap and place the tube in a glass shipping jar.
4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.
5. Package the PUF tube jars in a cooler that is filled with double-bagged ice. Use bubble wrap or other cushioning material to separate the samples and prevent breakage.
6. Place the chain-of-custody form within the cooler, seal the cooler, and apply a custody seal if required.
7. If coolers are used for shipping, tape instructions for returning the cooler to the inside of the lid.
8. Ship the samples by a method that will meet the holding time. Samples collected in PUF tubes typically must be extracted within 7 days of collection.

2.2 SHIPPING DOCUMENTATION FOR SAMPLES

Airbills, chain-of-custody forms, and custody seals must be completed for each shipment of nonhazardous environmental samples. Figures 1, 2, and 4 provide examples of these forms and instructions for completing them.

Field staff collecting samples should also review their field work plans to confirm what documentation must be completed during each sampling event, including client-specific requirements. For example, some EPA programs have a specific requirement to use Scribe software, an environmental data management system, to create sample documentation, electronically input information into Traffic Report or chain-of-custody forms, and enter other data.

- The Scribe software can be accessed from the EPA Environmental Response Team (ERT) at the following address: http://www.ertsupport.org/scribe_home.htm
- The ERT User Manual for Scribe, reference, and training materials can be accessed from the Scribe Support Web site at the following address: http://www.epaosc.org/scribe

Note that some laboratories must routinely return sample shipping coolers within 14 calendar days after the shipment has been received. Therefore, the sampler should also include instructions for returning the cooler with each shipment, when possible. The sampler (not the laboratory) is responsible for paying for return of the cooler and should include shipping airbills bearing the sampler's shipping account number, as well as a return address to allow for return of the cooler (see Figure 1). Samplers should use the least expensive option possible for returning coolers.

2.3 SHIPMENT DELIVERY AND NOTIFICATION

A member of the field sampling team must contact the laboratory to confirm it accepts deliveries on any given day, especially Saturdays. In addition, samplers should ensure the laboratory has been notified in advance of the pending shipment and notify any additional parties as required. The sampler needs to know the laboratory's contact name, address, and telephone number and be aware of the laboratory's requirements for receiving samples.

The sampler needs to know the shipping company's name, address, and telephone number (see Figure 1). In addition, samplers should be aware of the sample holding times, shipping company's hours of operation, shipping schedule, and pick-up and drop-off requirements to avoid delays in analytical testing.

Priority Overnight Delivery

Priority overnight delivery is typically the best method for shipment. Delays caused by longer shipment times may cause the sample temperature to rise above the acceptable range of 4° C (± 2 ° C) and technical holding may expire, which in turn may compromise sample integrity and require recollection of samples for analysis. If sample delivery procedures are to be modified for particular contract- or laboratory-specific requirements, the procedures should be clearly described in site-specific plans such as work plans, FSPs, or QAPPs.

Saturday Delivery

If planning to ship samples for Saturday delivery, the laboratory must be contacted in advance to confirm it will accept deliveries on Saturdays or arrange for them to be accepted. In addition, samplers should ensure the laboratory has been notified in advance of the pending shipment and notify any additional parties as required.

2.4 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of and follow the health and safety practices that result from the Activity Hazard Analyses (AHA) for the project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment (PPE) necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific Health and Safety Plan (HASP).

3.0 POTENTIAL PROBLEMS

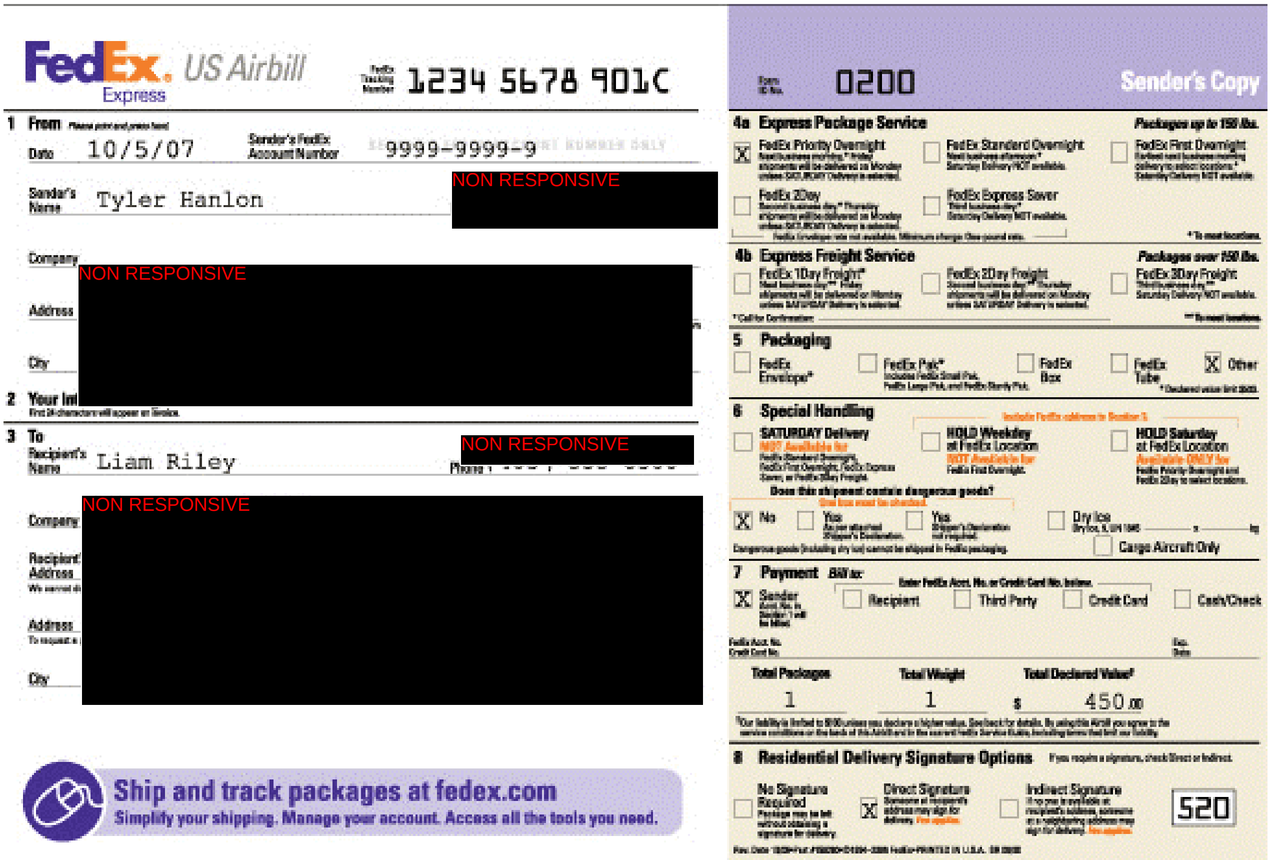
The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks, the carrier may open the package and return the package. Special care should be taken during sample packaging to minimize potential leaks.
- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment. A good practice is to have labels, forms, and container markings double checked by a member of the field team.
- Bulk samples and air samples delivered to the analytical laboratory in the same container. If samples are combined in this way, they will be rejected. Always ship bulk samples in separate containers from air samples.
- Issues in packing asbestos samples. When asbestos samples are shipped, avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials with asbestos samples because of possible contamination.
- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice these errors as well and return the package to the shipper. A good practice is to have another field tram member double check this information.
- Missed drop off time or wrong location. Missing the drop off time or having the wrong location identified for drop off will delay delivery to the laboratory and may cause technical holding times to expire. Establish the time requirements in advance of completing the field effort and be sure and provide some contingency time for potential delays such as traffic or checking and redoing paperwork.
- Incorrectly packaging samples for analysis at multiple laboratories. For example, inorganic samples may be shipped to one laboratory for analysis, while organic samples may need to be shipped to another laboratory. All field staff should be aware which samples are to be shipped to which laboratory they package samples for multiple types of analysis.
- Holidays or weather-related delays. Be aware of holidays and weather forecasts that could cause delays in delivery. Delays caused by longer shipping times may cause technical holding times to expire, which in turn may compromise sample integrity or require recollection of samples for analysis.
- Not noting field variances in field log book. Field variances should be noted in the field log book and the project manager notified. Common field variances include:
  - Less sample volume collected than planned. Notify appropriate staff and the laboratory to ensure there is an adequate amount for analysis.

- Sample collected into incorrect jar because of broken or missing bottle-ware. Notify appropriate laboratory staff to ensure there is no confusion regarding the analysis of the sample.

FIGURE 1

EXAMPLE OF A FEDEX US AIRBILL FOR LOW LEVEL ENVIRONMENTAL SAMPLES


FedEx Express US Airbill
FedEx Tracking Number 1234 5678 901C
Form I.D. No. 0200
Sender's Copy

1 From
Date 10/5/07
Sender's FedEx Account Number 9999-9999-9
Sender's Name Tyler Hanlon
[redacted]
Company [redacted]
Address
City
2 Your Internal Billing Reference
3 To
Recipient's Name Liam Riley
[redacted]
Phone
Company [redacted]
Recipient's Address
Address
City

Ship and track packages at fedex.com
Simplify your shipping. Manage your account. Access all the tools you need.

4a Express Package Service — Packages up to 150 lbs.
X FedEx Priority Overnight
FedEx Standard Overnight
FedEx First Overnight
FedEx 2Day
FedEx Express Saver

4b Express Freight Service — Packages over 150 lbs.
FedEx 1Day Freight
FedEx 2Day Freight
FedEx 3Day Freight

5 Packaging
FedEx Envelope
FedEx Pak
FedEx Box
FedEx Tube
X Other

6 Special Handling
SATURDAY Delivery
HOLD Weekday at FedEx Location
HOLD Saturday at FedEx Location
Does this shipment contain dangerous goods?
X No
Yes As per attached Shipper's Declaration
Yes Shipper's Declaration not required
Dry Ice
Cargo Aircraft Only

7 Payment Bill to:
X Sender
Recipient
Third Party
Credit Card
Cash/Check
Total Packages 1
Total Weight 1
Total Declared Value $ 450.00

8 Residential Delivery Signature Options
No Signature Required
X Direct Signature
Indirect Signature
520

Filling Out the FedEx US Airbill

- The sender *must complete* the following fields on the pre-printed airbill:
  - Section 1: Date
  - Section 1: Sender's FedEx Account Number
  - Section 1: Sender's Name, Company, Address, and Phone Number
  - Section 2: Internal Billing Reference (Project Number)
  - Section 3: Recipient's Name, Company, Address, and Phone Number
  - Section 4: Express Package or Freight Services (Priority Overnight)
  - Section 5: Packaging (usually "Other," your own packaging)
  - Section 6: Special Handling (Saturday delivery if prearranged with receiving laboratory; "No" dangerous goods contained in shipment)
  - Section 7: Payment ("Bill to Sender")
  - Section 7: Total Number of Packages
  - Section 7: Total Weight (completed by FedEx employee)
  - Section 8: Delivery Signature Options ("No Signature Required")

FIGURE 2

EXAMPLE OF A CHAIN-OF-CUSTODY FORM (WHITE COPY)

Tetra Tech EM Inc.
Oakland Office
1999 Harrison Street, Suite 500
Oakland, CA 94612
510.302.6300 Phone
510.433.0830 Fax

Chain of Custody Record No. 9814 13G175 Page 1 of 1

	Lab PO#: 13OAK27	**Lab:** EMAX
Project name: Concord PARNI	**TtEMI technical contact:** Sara Woolley	**Field samplers:** Sandy Jack, Rebecca Johnson
Project (CTO) number: 1036A59029	**TtEMI project manager:** Steve Dellhomme	**Field samplers' signatures:**

Preservative Added: SVOA: NONE; Metals: NONE; TPH Extractables: NONE

	Sample ID	Point ID/Depth	Date	Time	Matrix	MS / MSD	40 ml VOA	1 liter Amber	500 ml Poly	Sleeve	Glass Jar 8oz	250 ml Poly	Encore	VOA	SVOA	Pest	Metals	TPH Purgeables	TPH Extractables	PCB
1	029SRESS01		7/22/13	1240	Soil						2				X		X		X	X
2	029SRESS02		7/22/13	1245							2				X		X		X	X
3	029C3DSS01		7/24/13	1208							1				X		X		X	
4	029C3DSS02			1215							1				X		X		X	
5	029C3DSS03			1230							1				X		X		X	
6	029C3DSS04			1245							1				X		X		X	

	Name (print)	Company Name	Date	Time
Relinquished by:	Rebecca Johnson	TtEcoTt	7/26/13	1630
Received by:	Cecilia Chavez	EMAX	7/30/13	09:30
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

Turnaround time/remarks: Standard TAT Temp – 2.0°C
Prioritize: SVOCs, TPH-e on 029C3DSS01 → 04 then metals

1002

Fed Ex #: 8612 4667 7215

WHITE-Laboratory Copy YELLOW-Sample Tracker PINK-File Copy

Completing a Sample Chain-of-Custody Form

After samples have been collected, they will be maintained under chain-of-custody procedures. These procedures are used to document the transfer of custody of the samples from the field to the designated analytical laboratory. The same chain-of-custody procedures will be used for the transfer of samples from one laboratory to another, if required.

The field sampling personnel will complete a Chain-of-Custody and Request for Analysis (CC/RA) Form (Figure 1, Chain of Custody Record) for each separate container of samples to be shipped or delivered to the laboratory for chemical or physical (geotechnical) analysis. Information contained on the triplicate, carbonless form will include:

1. Project identification (ID) (for example, contract and task order number);
2. Project Contract Task Order (CTO) number;
3. Laboratory Project Order (PO) number;
4. Tetra Tech Technical Contact;
5. Tetra Tech Project Manager
6. Laboratory name;
7. Field sampler names;
8. Field sampler signature;
9. Sample ID;
10. Point ID and Depth (Do **NOT** include this information on the laboratory copy of the chain-of-custody (top white copy);
11. Date and time of sampling;
12. Sample matrix type;
13. Sample preservation method; note “NONE” if no preservatives;
14. Number and types of sample containers and container capacity;
15. Sample hazards (if any);
16. Requested analysis;
17. Requested sample turnaround time or any special remarks;
18. Page __ of __;
19. Method of shipment;
20. Carrier/waybill number (if any);
21. Signature, name, and company of the person relinquishing the samples and the person receiving the samples when custody is transferred;
22. Date and time of sample custody transfer;

23. Condition of samples when they are received by the laboratory.

The sample collector will cross out any blank space on the CC/RA Form below the last sample number listed on the part of the form where samples are listed.

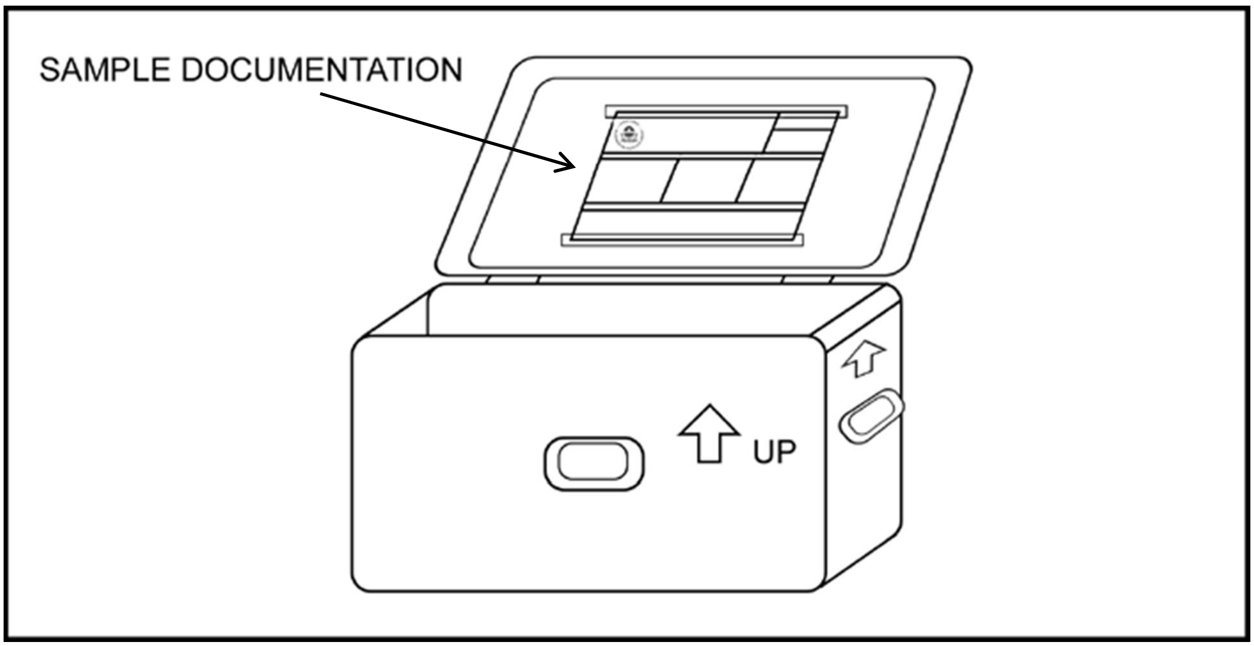
The sampling personnel whose signature appears on the CC/RA Form is responsible for the custody of a sample from time the sample is collected until the custody of the sample is transferred to a designated laboratory, a courier, or to another Tetra Tech employee for transporting a sample to the designated laboratory. A sample is considered to be in custody when the custodian: (1) has direct possession of it; (2) has plain view of it; or (3) has securely locked it in a restricted access area.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA Form under "Relinquished by" and "Received by" or a sample is left at a FedEx facility pending shipment. Signatures, printed names, company names, and date and time of custody transfer are required. When custody is transferred, the Tetra Tech sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA Form. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA Form. Receipts of Bills of Lading will be retained as part of the permanent documentation in the Tetra Tech project file.

FIGURE 3

EXAMPLE OF A SAMPLE COOLER WITH ATTACHED DOCUMENTATION

Place the necessary paperwork (chain-of-custody form, cooler return instructions, and associated paperwork) in the shipping cooler or acceptable container. All paperwork must be placed in a plastic bag or pouch and then secured to the underside of the shipping container lid.



Source: U.S. Environmental Protection Agency. 2011.

FIGURE 4

EXAMPLE OF A CUSTODY SEAL

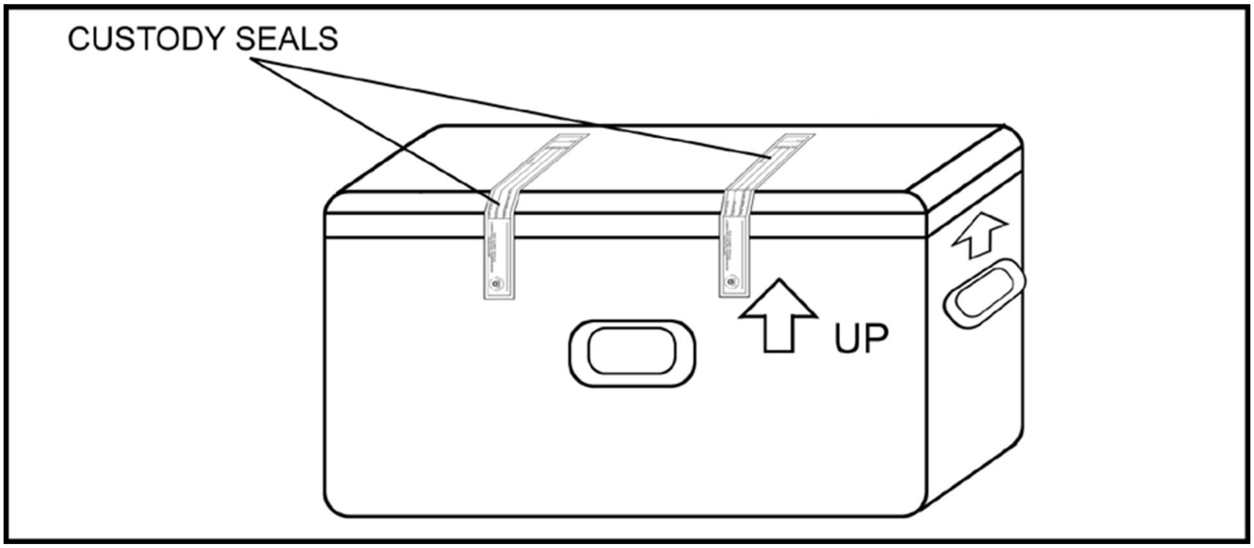
CUSTODY SEAL

Date ______________________________

Signature __________________________

FIGURE 5

EXAMPLE OF SHIPPING COOLER WITH CUSTODY SEALS



Source: U.S. Environmental Protection Agency. 2011.

Please note that the two seals typically are affixed *to opposite sides of the cooler and offset from each other*, although the offset is not depicted on the EPA figure above.

SOP APPROVAL FORM

TETRA TECH, INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING NOTES IN FIELD LOGBOOKS

SOP NO. 024

REVISION NO. 2

Last Reviewed: November 2014

______________________________	November 24, 2014
Quality Assurance Approved	Date

1.0 BACKGROUND

Complete and accurate field documentation is critical to a successful project and the field log book is an important tool to support field documentation needs. The field logbook should include detailed records of all field activities, document interviews with people, and record observations of conditions at a site. Entries should be described in a level of detail to allow personnel to reconstruct, after the fact, activities and events that occurred during their field assignments. Furthermore, entries should be limited to facts. Avoid speculation related to field events and do not record hearsay or unfounded information that may be presented by other parties during field activities. For example, do not record theories regarding the presence or absence of contamination when you are collecting field screening data or speculation regarding the reasons for a property owner's refusal to grant access for sampling.

Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate and detailed, but should not contain speculative information that could conflict with information presented in subsequent project deliverables and correspondence. Also be aware that the field logbooks for a site may be a primary source of information for depositions and other legal proceedings that may occur months or years after field work is complete and long after our memories have faded. The accuracy, neatness, and completeness of field logbooks are essential for recreating a meaningful account of events.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide guidance to ensure that field logbook documentation collected during field activities meets all requirements for its later use. Among other things, field logbooks may be used for:

- Identifying, locating, labeling, and tracking samples
- Recording site activities and the whereabouts of field personnel throughout the day
- Documenting any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel
- Recording arrival and departure times for field personnel each morning and evening and weather conditions each day
- Describing photographs taken during the project.

In addition, the data recorded in the field logbook may later assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining quality control, because it can verify adherence to project scope and requirements.

1.2 SCOPE

This SOP establishes the general requirements and procedures for documenting site activities in the field logbook.

1.3 DEFINITIONS

None.

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, NY.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Field logbooks
- Ballpoint pens or Sharpies with permanent waterproof ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers, and each page should have preprinted lines, numbered pages, and a single column. They should be approximately $7^1/_2$ by $4^1/_2$ inches or $8^1/_2$ by 11 inches in size. Loose-leaf sheets are not acceptable for use as field notes.* If notes are written on loose paper, they must be transcribed as soon as possible into a bound field logbook by the same person who recorded the notes originally. **Note: Data collection logs and field forms used to record field measurements and data are acceptable as loose-leaf sheets maintained in a three-ring binder with numbered pages.*

Ideally, distribution of logbooks should be controlled by a designated person in each office. This person assigns a document control number to each logbook, and records the assignment of each logbook distributed (name of person, date distributed, and project number). The purpose of this procedure is to ensure the integrity of the logbook before its use in the field, and to document each logbook assigned to a project. In the event that more than one logbook is assigned to a project, this process will ensure that all logbooks are accounted for at project closeout.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks, and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites (or operable units), designate a separate field logbook for each subsite. Similarly, if multiple activities are occurring simultaneously requiring more than one task leader (well installation, private well sampling, or geophysical survey.), each task leader should maintain a separate field logbook to ensure that each activity is documented in sufficient detail.
- At larger sites, a general field log may be kept at the site trailer or designated field office to track site visitors, document daily safety meetings, and record overall site issues or occurrences.
- Data from multiple subsites may be entered into one logbook that contains only one type of information for special tasks, such as periodic well water-level measurements.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed from the logbook for any purpose.
- All information must be entered using permanent, waterproof ink. Do not use pens with "wet ink," because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.
- Be sure that all entries are legible. Use print rather than cursive and keep the logbook pages free of dirt and moisture to the extent possible.
- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective. Avoid speculation that could conflict with information presented in subsequent project deliverables and correspondence (see Section 1.0 above).
- Use military time, unless otherwise specified by the client.
- Include site sketches, as appropriate.
- Begin a new page for each day's notes.
- Include the date at the top of each page.
- At the end of a day, draw a single diagonal line through any unused lines on the page, and sign at the bottom of the page. Note and implement any client specific requirements (for example, some U.S. Environmental Protection Agency (EPA) programs require each logbook page to be signed).

- Write notes on every line of the logbook. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.
- If a line is left blank for some reason, cross out (with a single line) and initial to prevent unauthorized entries.
- Cross out (with a single line) and initial any edits to the logbook entries. Edits should only be made if the initial entry is illegible or erroneous. Do not make corrections for grammar or style.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent and generally follow the format guidelines presented below. Some clients or contracts may have specific formatting guidelines that differ somewhat from this SOP; review client requirements at the start of the project to help ensure any client-specific guidelines are integrated.

2.2.1 Logbook Cover

Write the following information on the front cover of each logbook using a Sharpie or similar type permanent ink marker:

- Logbook document control number (assigned by issuer)
- "Book # of #" (determined by the project manager if there is more than one logbook for the project)
- Contract and task order numbers
- Name of the site and site location (city and state)
- Name of subsite (or operable unit), if applicable
- Type of activity (if logbook is for specific activity, such as well installation or indoor air sampling)
- Beginning and ending dates of activities entered into the logbook

2.2.2 Inside Cover or First Page

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Tetra Tech project manager and site manager and phone numbers
- Tetra Tech office address

- Client contact and phone number
- Site safety officer and phone number
- Emergency contact phone number (911, if applicable, or nearest hospital)
- Subcontractor contacts and phone numbers
- Site property owner or property manager contact information

2.3 ENTERING INFORMATION IN THE LOGBOOK

The following lists provide guidance on the type of information to be included in a typical field logbook. This guidance is general and is not intended to be all-inclusive. Certain projects or clients may specify logbook requirements that are beyond the elements presented in this SOP.

General Daily Entries:

- Document what time field personnel depart the Tetra Tech office and arrive at the hotel or site. If permitted by the client to charge travel time for site work, document what time personnel leave and arrive at the hotel each day. (This information may be needed at remote sites where hotel accommodations are not near the site.)
- Indicate when all subcontractors arrive and depart the site.
- Note weather conditions.
- Include the date at the top of each page.
- Document that a site safety meeting was held and include the basic contents of the meeting.
- List the level of protection to be used for health and safety.
- Summarize the day’s planned activities.
- Summarize which activities each field team member will be doing.

Field Activity Entries:

- Refer to field data collection forms for details about field data collection activities (for example time, date, depth of samples, field measurements). If separate field sampling sheets are not used, see section below regarding logbook entries for sampling activities.
- Refer to well purge forms, well construction logs, and other activity-specific forms as applicable rather than including this type of information in the field logbook. These other forms allow the information to be more accessible at a later date.
- List any air monitoring instrumentation used, with readings and locations.
- Refer to instrument field logs for equipment calibration information.
- Summarize pertinent conversations with site visitors (agency representatives, property owners, client contacts, and local citizens).
- Summarize any problems or deviations from the quality assurance project plan (QAPP) or field sampling plan.
- Document the activities and whereabouts of each team member. (As indicated in Section 2.1, multiple logbooks may be required to ensure sufficient detail for contemporaneous activities).
- Indicate when utility clearances are completed, including which companies participated.
- Indicate when verbal access to a property is obtained.
- Include names, addresses, and phone numbers of any pertinent site contacts, property owners, and any other relevant personnel.
- Document when lunch breaks or other work stoppages occur.
- Include approximate scale for all diagrams. If a scale is not available, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections, and label features on each diagram.

Sampling Activity Entries: The following information should typically be on a sample collection log and referenced in the log book. If the project does not use sample sheets as a result of project-specific requirements, this information should be included in the logbook.

- Location description
- Names of samplers
- Collection time
- Designation of sample as a grab or composite sample
- Type of sample (water, sediment, soil gas, or other medium)
- On-site measurement data (pH, temperature, and specific conductivity)

- Field observations (odors, colors, weather)
- Preliminary sample description
- Type of preservative used.
- Instrument readings, if applicable

Closing Daily Entries:

- Describe decontamination procedures (personnel and equipment).
- Describe handling and disposition of any investigation-derived wastes.
- Summarize which planned activities were completed and which ones were not.
- Note the times that personnel depart site for the day.
- Summarize any activities conducted after departing the site (paperwork, sample packaging, etc.). This may be required to document billable time incurred after field activities were completed for the day.

Photographic Log Entries:

- For digital photographs, indicate in the text that photographs were taken and the location where the photographs can be found (for example, in the project file).
- Camera and serial #
- Photographer
- Date and time of photograph
- Sequential number of the photograph and the film roll number or disposable camera used (if applicable)
- Direction of photograph
- Description of photograph

2.4 LOGBOOK STORAGE

Custody of logbooks must be maintained at all times. During field activities, field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. When the field work is over, the logbook should be included in the project file, which should be in a secured file cabinet. The logbook may be referenced in preparing subsequent reports and may also be scanned for inclusion as an appendix to a report. However, it is advisable to obtain direction directly from the client before including the logbook as a report appendix, because its inclusion may not be appropriate in all cases.

2.5 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of and follow the health and safety practices that result from the Activity Hazard Analyses (AHAs) for a project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment (PPE) necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific Health and Safety Plan (HASP).

STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services 2890 Woodbridge Avenue Building 209 Annex Edison New Jersey 08837-3679	
STANDARD OPERATING PROCEDURE	
Title: Chip, Wipe and Sweep Sampling	
Approval Date: 08/28/15	
Effective Date: 08/31/15	SERAS SOP Number: 2011, Rev 1.0
Authors	
Name Amy DuBois Title Air Environmental Scientist Signature	Date 8/28/15
Name Title Signature	Date
Approvals	
Name Philip Solinski Title SERAS Air Response Chemist Signature	Date 8/28/15
Name Title Signature	Date
Name Deborah Killeen Title SERAS QA/QC Officer Signature	Date 8/28/15
Name Kevin Taylor Title SERAS Program Manager Signature	Date 8/28/15

The top row of this table shows the most recent changes to the controlled document. For previous revision history information, archived versions of this document are maintained by the SERAS QA/QC Officer on the SERAS local area network (LAN).

History	Effective Date
Supersedes: SOP #2011, Revision 0.0 dated 11/16/1994	08/31/15
Editorial changes	

CHIP, WIPE, AND SWEEP SAMPLING

CONTENTS

SUPERCEDES: SOP #2011; Revision 0.0; 11/16/94; U.S. EPA Contract 68-03-3482

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the recommended protocol and equipment for collection of representative chip, wipe, and sweep samples to monitor potentially contaminated surfaces. This method of monitoring surficial contamination is appropriate for surfaces contaminated with non-volatile species of analytes (i.e., PCB, PCDD, PCDF, metals, cyanide, etc.). Detection limits are analyte specific. Sample size should be determined based upon the detection limit desired and the amount of sample requested by the analytical laboratory. Typical sample area is one square foot for lead and 100 squared centimeter (cm^2) for many other analytes. However, based upon sampling location, the sample size may need modification due to area configuration.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

Since surface situations vary widely, no universal sampling method can be recommended. Rather, the method and implements used must be tailored to suit a specific sampling site. The sampling location should be selected based upon the potential for contamination as a result of manufacturing processes or personnel practices.

Chip sampling is appropriate for porous surfaces and is generally accomplished with either a hammer and chisel, or an electric hammer. The sampling device should be laboratory cleaned and wrapped in clean aluminum foil until ready for use. To collect the sample, a measured and marked off area is chipped both horizontally and vertically to an even depth of 1/8 inch. The sample is then transferred to the proper sample container.

Wipe samples are collected from smooth surfaces to indicate surficial contamination; a sample location is measured and marked off. While wearing a new pair of contaminant-free gloves, the wipe sampling media (e.g., a sterile gauze pad or filter paper) is opened, and wetted with solvent. The solvent used is dependent on the surface and contaminant being sampled. This pad is then stroked firmly over the sample surface in a reproducible pattern, first vertically, then horizontally, to ensure complete coverage. The wipe sampling media is then transferred to the sample container.

Sweep sampling is an effective method for the collection of dust or residue on porous or non-porous surfaces. To collect such a sample, an appropriate area is measured off. Then, while wearing a new pair of disposable contaminant-free gloves, a dedicated brush is used to sweep material into a dedicated dust pan. The sample is then transferred to the proper sample container.

Samples collected by all three methods are then sent to the laboratory for analysis.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Depending on the contaminants to be sampled, samples should be stored out of direct sunlight to reduce photodegradation, cooled on ice to ≤6ºC and shipped to the laboratory performing the analysis. Appropriately sized laboratory cleaned, glass sample jars should be used for sample collection. The amount of sample required will be determined in concert with the analytical laboratory.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

This method has few significant interferences or problems. Typical problems result from rough porous surfaces which may be difficult to wipe, chip, or sweep.

5.0 EQUIPMENT

Equipment required for performing chip, wipe, or sweep sampling is as follows:

- Lab clean sample containers of proper size and composition
- Site logbook
- Sample analysis request forms
- Chain of Custody records
- Custody seals
- Field data sheets
- Sample labels
- Scribe Software
- Tape measure
- Disposable contaminant-free gloves
- Plastic sheet or cardboard template (100-squared centimeters or 1-square foot)
- Sterile wrapped gauze pad (3 in. x 3 in.) or appropriate filter paper
- Laboratory cleaned paint brush
- Stainless steel laboratory cleaned chisel
- Aluminum foil
- Camera to document exact locations

NOTE: This check list is provided as a guide and is not intended to be all-inclusive.

6.0 REAGENTS

- Appropriate pesticide or HPLC grade solvent, depending on the analyte of interest
- Distilled/deionized water

For non-dedicated equipment, reagents will be utilized for decontamination of sampling equipment. Decontamination solutions are specified in SERAS SOP #2006, *Sampling Equipment Decontamination*.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort and the sampling methods to be employed. Additionally, the types and amounts of equipment and supplies need to be determined.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan (HASP).

6. Mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries and surface obstructions.

7.2 Chip Sample Collection

Sampling of porous surfaces is generally accomplished by using a chisel and hammer or electric hammer. The sampling device should be laboratory cleaned or field decontaminated as per SERAS SOP# 2006, *Sampling Equipment Decontamination*. It should then be wrapped in clean aluminum foil and kept in this wrapping until it is needed. Each sampling device should be used for only one sample until decontamination is performed again.

Choose appropriate sampling points; measure off the designated area. Photo documentation is optional. Record surface area to be chipped.

1. Don a new pair of disposable contaminant-free gloves.

2. Use a cleaned chisel or equivalent sampling device and chip the sample area horizontally, then vertically to an even depth of approximately 1/8 inch.

3. Place the sample in an appropriately prepared sample container with a Teflon-lined cap.

4. Cap the sample container, attach the label and place in a plastic bag.

5. Record all pertinent data in the site logbook, on field data sheets and in Scribe. Complete the Chip Sampling Sheet and Chain of Custody record.

6. As appropriate, store samples out of direct sunlight and cool to ≤6°C.

7. Follow proper decontamination procedures then deliver sample(s) to the laboratory for analysis.

7.3 Wipe Sample Collection

Wipe sampling is accomplished by using clean sampling media (e.g.. a sterile gauze pad, Ghost wipes for metals, filter paper or special wipes for asbestos), adding a solvent (if not already provided with the wipe) in which the contaminant is most soluble, then wiping a pre-determined, pre-measured area. The sample is packaged in an amber jar to prevent photodegradation and packed in coolers for shipment to the lab. Each sampling media is used for only one wipe sample. Consult with the laboratory conducting the analysis to ensure that the media and solvent is appropriate for the analysis. The media and solvent may be acquired from the laboratory performing the analysis or purchased separately.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record surface area to be wiped or use 100 cm^2 (or 1-foot square) paper or plastic templates.

3. Don a new pair of disposable contaminant-free gloves.

4. Open sampling media (e.g., a 3-in. x 3-in. sterile gauze pad) and record the lot number.

5. Moisten the sampling media with one to two milliliters of the appropriate solvent of choice or apply sufficient solvent to moisten approximately 80 percent of the media. Do not add excess solvent as this may cause loss of sample.

6. Wipe the marked surface area using firm strokes vertically and horizontally. Continue with approximately 10 strokes in each direction until the surface has been completely covered.

7. Alternatively with each wiping step, fold the sampling media exposed surface inward and continue surface wiping and inward folding of the sampling media until the wiping steps are completed.

8. Place the sampling media in a 40-milliliter amber vial or an appropriately prepared sample container with a Teflon-lined cap.

9. Cap the sample container, attach the label and place in a plastic bag. Record all pertinent data in the site logbook, on field data sheets and in Scribe. Complete the Wipe Sampling Sheet and Chain of Custody record.

10. As appropriate, store samples in a cooler out of direct sunlight using a 40-milliliter amber vial and cool to $\leq 6^{o}C$ using ice.

11. Follow proper decontamination procedures, and then deliver sample(s) to the laboratory for analysis.

7.4 Sweep Sample Collection

Sweep sampling is appropriate for bulk contamination. This procedure utilizes a dedicated, hand held sweeper brush to acquire a sample from a pre-measured area.

1. Choose appropriate sampling points; measure off the designated area. The area sampled should be large enough to provide sufficient sample for analysis. Photo documentation is optional.

2. Record the surface area to be swept.

3. Don new pair of disposable contaminant-free gloves.

4. Sweep the measured area using a dedicated clean brush; collect the sample in a dedicated dust pan.

5. Transfer sample from dust pan to sample container.

6. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site log book, on field data sheets and in Scribe. Complete the Sweep Sampling Data Sheet and Chain of Custody record.

7. As appropriate, store samples out of direct sunlight and cool to ≤6ºC.

8. Follow proper decontamination procedures, and then deliver sample(s) to the laboratory for analysis.

8.0 CALCULATIONS

Results are usually provided in milligram per gram (mg/g), microgram per gram (µg/g), mass per unit area, or other appropriate measurement. Calculations are typically done by the laboratory.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific QA/QC activities that apply to the implementation of these procedures will be listed in the Quality Assurance Project Plan prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All sample collection data, including sample collection methods, times of collection, analyses required, and decontamination procedures (if any) must be documented on field datasheets or in site logbooks.

2. For wipe samples, a field blank should be collected for each sampling event. This consists of the appropriate sampling media, wetted with the appropriate solvent, and placed in a 40-milliliter amber glass vial or in an appropriately prepared container with a Teflon-lined cap. The blank will help identify potential introduction of contaminants via the sampling methods, the media, solvent or sample container. Alternatively, the template may be wiped, if not dedicated to ensure that no transfer of contaminants occurs from area to area.

Specific quality assurance activities for chip and sweep samples should be determined on a site specific basis.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to: location information, approximate area, sample number, date and time of collection, and solvent and media lot numbers. These data are essential to providing an accurate and complete final deliverable. The SERAS Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, Occupational Safety and Health Administration (OSHA) and SERAS health and safety guidelines. More specifically, depending upon the site specific contaminants, various protective programs must be implemented prior to sampling. The site's health and safety plan (HASP) should be reviewed with specific emphasis placed on the protection program planned for the sampling tasks. Standard safe operating practices should be followed such as minimizing contact with potential contaminants.

12.0 REFERENCES

OSHA Instruction CPL 2-2.20B: Sampling for Surface Contamination, February 5, 1990

Brookhaven National Laboratory, Surface Wipe Sampling Procedure, February 9, 2009

NJDEP Field Sampling Procedures Manual, August 2005

13.0 APPENDIX

There is no appendix associated with this SOP.

SOP APPROVAL FORM

TETRA TECH EM INC.

LABORATORY ANALYTICAL DATA STANDARD OPERATING PROCEDURE

Laboratory Analytical Data Verification – Minimum Requirements

SOP NO. 203

REVISION NO. 00

Last Reviewed: August 2010

Quality Assurance Approved	August 24, 2010 Date

1.0 BACKGROUND

Data quality assurance (QA) is necessary for every project. It is the total integrated process for assuring reliability and defensibility of decisions based on data—including analytical data. In particular, appropriate level and accurate review of data resulting from chemical and physical analysis are essential to ensure these data are of sufficient quality to support the project's technical requirements.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to ensure laboratory data used by Tetra Tech to make project decisions are of the quality required and provide the level of confidence needed to make the appropriate project decisions. This SOP specifies data verification guidelines for ensuring achievement of a minimum level of project data QA.

1.2 SCOPE

Analytical data generated for Tetra Tech projects must receive the appropriate level of data review. The level of detail and stringency of data verification or data validation depends on the needs of the project and program. This SOP specifies guidance for data verification procedures when program-specific or regulatory requirements are not defined contractually or by program procedures and regulations (for example, Phase II Environmental Site Assessments, emissions monitoring, and compliance reporting data for permit applications).

1.3 DEFINITIONS

This subsection defines key terms used in the text.

Data package – A hard copy or electronic report from an analytical laboratory for a set of chemical and physical analyses performed on a group of samples (sometimes referred to as a Sample Delivery Group [SDG]). The data package should contain sufficient QA documentation to complete data verification and determine data usability.

Data usability – A qualitative decision process whereby a qualified person determines whether the data may be used for the intended purpose. Data should be classified into one of the following two categories: usable or rejected (unusable).

Data verification – The act of determining and documenting whether data conform to specified requirements. The determination may involve processes such as reviewing, inspecting, testing, checking, recalculating, and auditing.

Rejected data – Data that do not conform to some or all requirements considered critical to assuring and confirming the quality of the data. Nonconformances may include: (1) critical quality control (QC) criteria are not met (see Table 1); (2) appropriate methods were not followed or the methods used involved significant deviations that might impact data quality or meaning; and (3) critical documentation is missing or incomplete.

Sample delivery group – A unit (group) of samples received by the laboratory during a field sampling event. A "sample date group" (SDG) is typically comprised of 20 or fewer samples, and is grouped based on the number of samples and not the analytical testing requested. A SDG may be defined based on the number of samples received by the laboratory on a given day or over a period of up to 7 calendar days.

Qualified person – A chemist or other person who received training in or has demonstrated skills and knowledge of laboratory procedures and QC. The qualified person involved in data verification should understand the data generation procedures and know project documentation and data quality requirements.

Usable data – Data conforming to most or all requirements considered critical to assuring and confirming the quality of the data. Conformances important to achieve usability include: (1) critical QC criteria are met (see Table 1); (2) appropriate methods were followed, or only minor deviations to the methods were made that would not impact data quality or meaning; and (3) critical documentation is complete. Professional judgment by a qualified person should be used to determine data usability.

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 2002. Guidance on Environmental Data Verification and Data Validation EPA, QA/G-8. EPA/240/R-02/004. November. On-line address: http://www.epa.gov/quality/qs-docs/g8-final.pdf

EPA. 2005. "USEPA Analytical Services Branch (ASB) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review." September. On-line address: http://www.epa.gov/superfund/programs/clp/download/dlm/dlm2nfg.pdf

EPA. 2008. "USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review." June. On-line address: http://www.epa.gov/superfund/programs/clp/download/somnfg.pdf

EPA. 2009. "USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use." January. On-line address: http://www.epa.gov/superfund/policy/pdfs/EPA-540-R-08-005.pdf.

EPA. 2010. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review." January. On-line address: http://www.epa.gov/superfund/programs/clp/download/ism/ism1nfg.pdf

1.5 REQUIREMENTS AND RESOURCES

The following are required for laboratory data verification as described in this SOP:

- Laboratory data package(s)
- Project-specific information for data use (i.e. work plan, sampling and analysis plan [SAP], quality assurance project plan [QAPP], proposal, or purchase order)
- Qualified person, familiar with laboratory procedures and capable of determining data usability.

Laboratory data package(s) should include the following to allow for data verification:

- Cover letter or case narrative, including the laboratory name and address, that certifies analytical results via signature of the project chemist, QA manager, or laboratory manager
- Signed field chain-of-custody form(s)
- Sample receipt and log-in forms, which include general comments and specify temperature, holding time, bottle breakages, and any nonconformances or discrepancies
- Laboratory log-in summary, including laboratory sample identification (ID), field sample ID, list of analyses performed, and analytical methods employed
- Analytical results
- Applicable analytical batch QC results (for example, method and field blanks, surrogate spikes, matrix spike/matrix spike duplicates [MS/MSD], and laboratory control sample/laboratory control sample duplicates [LCS/LCSD])
- List of laboratory data qualifier definitions.

Time required for laboratory data verification can vary greatly depending on the number of analyses per data package and the number of samples per data package. The following rules of thumb, including producing a record of the type found in Attachment A, may be useful for planning purposes:

- 30 minutes for a SDG with one major analysis (e.g., metals or volatiles)
- 90 minutes to 2 hours for a SDG with a common suite of analyses (e.g., metals, volatiles, semivolatiles, pesticides, polychlorinated biphenyls, and total petroleum hydrocarbons)
- 30 minutes for a SDG with a common suite of wet chemistry analyses (e.g., alkalinity, pH, major anions, total organic carbon, total dissolved solids, and total suspended solids).

The times noted are estimates only. Involving a qualified person in the planning process will help ensure proper budget for data verification.

2.0 PROCEDURES

Step 1 – The project manager identifies a qualified person with an understanding of laboratory data generation and usability to review and verify the data. If the data are released to the client prior to verification, the client should be advised that the data are preliminary pending this review.

Step 2 – The qualified person identifies the project analytical QA/QC needs for documentation and technical specifications as these apply to data content and quality. A work plan, SAP, QAPP, regulatory guidance, laboratory analytical method, client contract, or project scope of work may identify the technical specifications and QA/QC requirements.

Step 3 – The qualified person reviews the data and documents the review findings based on the requirements for data quality needed to achieve project objectives. Serious issues regarding data usability are immediately brought to the project manager’s attention for further discussion and resolution. Table 1 describes the elements of data verification.

In all cases, the laboratory chain-of-custody indicating sample IDs, matrices, and analytical methods—and perhaps frequency of collection and submittal of QA/QC samples (i.e., field duplicates, trip blanks, field blanks, equipment rinsate blanks, and MS/MSDs)—should be cross-checked with the SAP or the contracted scope of work.

In each case, professional judgment should be used to determine data usability. Ultimately, the project manager’s responsibility is to ensure a qualified person has reviewed the laboratory data package, and has deemed the data usable for the data’s intended purpose.

Step 4 – The qualified person reviews and compares the analytical method detection limits (MDL), reporting limits (RL), and practical quantitation limits (PQL) for compliance with project requirements. Explicit definition and clarification of MDLs, RLs, and PQLs should be established prior to field activities.

Step 5 – The qualified person communicates findings. The deliverable from the qualified person includes at least one of the following:

- An e-mail indicating data usability
- A memo summarizing the evaluated results
- A table of data showing data points considered biased or outside acceptance criteria for various data quality indicators by a large enough factor that use of the data might affect environmental decisions.

Some written form of communication should be provided for the project file. An example of a minimum data verification deliverable is included as Attachment A.

3.0 DATA VERIFICATION RESULTS

As described above, potential data verification issues involving the following designations may be encountered during this process:

Rejected data – During verification, the qualified person may reject some or all of the data (consider the data unusable). If laboratory data are rejected due to poor quality, the project manager may ask the laboratory to re-analyze the extracts, or re-digest and/or re-extract the original sample if enough volume remains.

Inadequate data – The qualified person may find the data inadequate for the intended purpose, even if all QC criteria were met—for example, a case in which laboratory reporting limits are not adequate to meet the comparison or screening values established during the project planning process.

Incomplete data packages – The data package provided by the laboratory may not be complete. If the laboratory data package does not include the minimum contents defined in Section 1.5, the laboratory should be notified and required to issue a revised data package.

If encountered, any of the above data designations should be addressed immediately and corrected to minimize effects on future project deliverables. Further discussion with the analytical laboratory may help in the effort to address each of the above designations. The data verifier and the project manager should discuss potential remedies or corrective measures to minimize impact(s) of the above designations on project analytical data and decisions based on those data.

Table 1
Elements of Laboratory Data Verification

Data Report Element	Minimum Required Review	Actions
Chain-of-custody	Review laboratory log-in forms against chain-of-custody forms and the contracted scope of work (SAP) for: accuracy and completeness of documentation, sample quantity and IDs, proper signatures attesting to chain-of-custody, sample condition upon receipt (breakage, temperature, etc.), sample preservation (see below), and analytical method selection.	Discrepancies regarding log-in, chain-of-custody, analytical method selection, or related issues should be immediately addressed. If discrepancies are identified, the laboratory should be contacted immediately and corrective actions implemented. Improper sample handling and preservation should be investigated to determine sample adequacy (see below).
Data package completeness	Review data package to make sure that all requested analytical procedures have occurred and required corresponding data are reported.	Analytical results that lack supporting data and information may be considered invalid and not usable for the purpose intended. Such conditions should be immediately addressed with the project team and laboratory.
Sample preservation, storage, and holding times	Review sample preservation, storage, and holding times in compliance with selected analytical method and matrix.	Analytical results of samples not properly preserved and stored, or digested/extracted or analyzed outside the appropriate holding time, may be considered invalid and not usable for the purpose intended. Such conditions should be immediately addressed with the project team.
Method and field blanks	Review blank data for positive results that may indicate possible field or laboratory contamination.	If blank contamination is found in either the laboratory method blanks or the field QC blanks (i.e., equipment rinsate blanks, source or field blanks, or trip blanks), associated sample results should be reviewed. Detections in the associated environmental samples may be attributed to laboratory or field contamination, and qualifications of the data may be necessary.
Precision and accuracy* (may include surrogate spikes, MS/MSDs, and LCS/LCSDs)	Review QC data summaries for the analytical method used. Use project-required, method-required, or laboratory-provided control limits. Review laboratory-assigned data quality flags and notations, and revise if necessary.	In general, recoveries and relative percent difference values for surrogate spikes, MS/MSDs, and LCS/LCSDs that fall outside of the specified control limits may indicate problems with the laboratory analysis.*

Notes:

* The type and amount of QC information available for review will depend upon the analytical method and level of data package requested.

ID	Identification	QC	Quality control
LCS/LCSD	Laboratory control sample/laboratory control sample duplicate	SAP	Sampling and analysis plan
MS/MSD	Matrix spike/matrix spike duplicate		

ATTACHMENT A
EXAMPLE DATA VERIFICATION REPORT

Prepared by: ______________________

Date: ______________________

Site Name/Job Number: ______________________

Laboratory: ______________________

Data Package or SDG Number: ______________________

Sample Designations/Names (ID): ______________________

Matrices: ______________________

Analytical Parameters: ______________________

Data Package Element	Usable	Rejected	NA	Description of Affected Data (note specific samples and analytical parameters affected)
Chain of custody	__	__		
Data package completeness	__	__		
Sample preservation, storage, and holding times				
Method and field blank contamination				
Surrogate spikes				
Matrix Spikes/Matrix Spike Duplicates (MS/MSD)				
Laboratory Control Samples/Laboratory Control Sample Duplicates (LCS/LCSD)				
Other				
Summary				